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EDITORIAL

Cocoa in Malaya.

Undoubtedly what might prove to be one of the two major developments in Malayan agriculture since the introduction of the oil palm is the possible extension of the cocoa industry to this country. The other major development is, of course, that of mechanization.

Prior to the war, world demand for cocoa was met satisfactorily from existing sources of supply, and the market price was less than £22 per ton. The post war picture is a different one. In common with all other food supplies cocoa production is far short of demand, and the Ministry of Food's selling price early in 1948 was £225.10s.

Consideration was therefore given to the possibility of introducing cocoa to this country as an additional crop to diversify and strengthen Malaya's agricultural economy. Although a certain amount of knowledge had been gained regarding cocoa in Malaya as a result of experimentation before the war it was rightly considered that before recommendations could be made for the development of the crop on a commercial basis expert opinion should be sought. Accordingly Government asked the Secretary of State for the services of an expert to make a thorough investigation into the potentialities in Malaya for the cultivation of cocoa.

As a result of this request the Secretary of State arranged for Professor E. E. Cheesman, a recognized authority on cocoa cultivation, to visit Malaya, Sarawak and North Borneo at the end of 1947, and an abstract of his Report included in this issue gives the sections which are relevant to Malaya.

While Professor Cheesman points out that no considerable output can be looked for within the next ten years owing principally to the need for the provision of material for large-scale planting he envisages a possible annual production of 100,000 tons when the crop is established.

The problem of providing the Malayan small-holder with a satisfactory alternative cash crop to rubber has long exercised the minds of officers of the Department of Agriculture, and it is therefore extremely encouraging to read that Professor Cheesman considers that "cocoa may well become an important small-holders' crop in Malaya, and should be particularly useful as the cash-crop basis of land settlement schemes in some of the sparsely populated districts." No immediate developments in this direction can,

however, be expected until the results of experimental work are available, so that it can reasonably be assured that the small-holder will not run any risk of failure in giving up land to this new crop. Professor Cheesman also draws attention to the fact that " the successful establishment of " kampong " cocoa will involve either the organisation of central fermentaries or the education of numerous small growers in the art of preparation of the beans for sale, and the time will not be ripe for either for a good many years to come."

In his recommendations applicable to Malaya, Professor Cheesman writes as follows:

> " The prospects for cocoa growing in Malaya appear sufficiently good to justify expenditure on serious attempts to establish the crop on a commercial scale. If it is to be established, soundly, however, the attempts must begin with a programme of experimental investigation designed to confirm the findings of this preliminary survey of possibilities."

We have quoted this recommendation again in this place, and would particularly stress the last sentence of it, wherein lies the special responsibility of the Department of Agriculture. The Department has already taken active measures to implement the recommendations of Professor Cheesman, and during his visit work was commenced as a result of discussions with him in order to anticipate as far as possible the results of his survey.

We publish in this number the salient portions of a memorandum to Government by the Acting Director of Agriculture, Dr. A. E. S. McIntosh, in which he comments on Professor Cheesman's Report and summarizes the progress of the Department to date in the preliminary investigational work which is to form the basis of this new industry. From this memorandum it will be seen that experimentation in all aspects of cacao propagation has already commenced. The co-operation of estates is being obtained in carrying out planting on small selected sites by planting and cultivation methods recommended by the Department. Already, nearly 40 estates have commenced planting or signified their intention of planting in accordance with the Department's scheme.

With reference to the introduction of planting material every precaution is being taken to exclude serious diseases and pests of cocoa occurring both in the West Indies and West Africa. Among others, schemes for intermediate quarantine are being drawn up, and progress has already been made in the selection of a considered " safe " island off the mainland of Malaya to serve as an isolation garden.

Professor Cheesman made the important recommendation that it was highly desirable that an additional research officer with experience of cocoa should be appointed to deal specially with the work in the Federation. The Secretary of State for the Colonies has already expressed his intention of

accepting this recommendation, and it is hoped that a specialist Cocoa Officer will shortly be appointed.

We have, therefore, before us the prospect of the development of an important new agricultural crop in Malaya, important for both the plantation industry and the small-holder. It is clear that cautious optimism must be our attitude, but that does not prevent us from expressing the hope that the introduction of this crop will be attended with complete success, and that it will bring additional prosperity to the agricultural population of the country.

The Small-holder. Malay vernacular newspapers have in recent months commented on the poverty of the small-holder, and have implied that little is done to assist their agricultural development. One paper suggested that the fact that rice is rationed and that at one time it was necessary to eat tapioca, sweet potato and bananas indicated that Government had never shown real interest in the progress of agriculture in Malaya.

While few thinking people will be misled by such ill-informed comment, it is nevertheless desirable that it should be answered officially. The Field Branch of the Department of Agriculture has, at full strength, a staff of 17 Agricultural Officers, together with a staff of 7 Malay Agricultural Officers, 83 Agricultural Assistants, and 135 Malay Agricultural Subordinates. The energies of this large staff are devoted almost exclusively to giving every possible assistance to the small-holder, Malay, Chinese or Indian. There are over 30 Agricultural Stations and nearly 50 Padi Test Stations in the Federation solely engaged in investigational work for the improvement of small-holding agriculture.

The Department has a long record of padi investigational work to its credit, and that it fully realizes the need for the continued urgent prosecution of this work is shown by the fact that a senior research officer is engaged full time on padi varietal selection. It may not be fully appreciated that the average yield of rice per acre in Malaya is higher than that of the principal rice-producing countries in the tropics.

In an article published in this issue, entitled " Government and the Small-holder," Mr. J. R. P. Soper, Acting Chief Field Officer, shows in more detail what is being done for the small-holder in this country. It is necessarily only a summary of a large subject, but it is sufficient to show how unfounded is the comment to which we refer.

1949 Subscription. We must regretfully notify subscribers to this Journal that, commencing with January, 1949, the price per issue will be increased to $2, or $8 per annum, post free in Malaya. ($8.50 or £1 sterling post free outside Malaya).

Original Articles.

GOVERNMENT AND THE SMALL-HOLDER

BY

J. R. P. Soper,

Acting Chief Field Officer.

From time to time there appear in the local vernacular press criticisms accusing the Government of lethargy in providing assistance to small-holders. These criticisms frequently display an ignorance of the facts, and it is therefore felt that a statement of some of Government's activities may help to correct the false impression which is being created in some quarters.

Before proceeding to a detailed account of the facilities now being provided by the various departments of Government, consideration should be given to two factors which must constantly be borne in mind when assessing the value and extent of these services. The first of these is the time factor. A large irrigation project cannot be brought into operation overnight, nor can results be obtained from an agricultural experiment in a fortnight as may be the case when a scientist is working with chemicals in a laboratory. Plants and animals take time to grow, and even in Malaya they have their seasons of growth: furthermore the results obtained during one season may not be applicable in the following year under different weather conditions. Repetition is absolutely essential before confident recommendations can be made. Five years is a short period in agricultural research, and it generally takes ten years from the inception of work before seed of a new fully tested variety of padi, for instance, is available in commercial quantities. A great deal of the work which has been started since the liberation both by the Agricultural and Drainage & Irrigation Departments has therefore not yet had time to bear fruit, but it is going ahead nevertheless.

The second factor is a human one. Peasants and small-holders all over the world are notoriously conservative, and are often loath to adopt new methods or to grow new varieties even though they have before them apparently convincing evidence of the benefits to be derived from changing their customs. They are inclined to underrate their own powers, and prefer to watch the one or two brave spirits who are persuaded, after much hard work on the part of the advisory officer, to break away. This causes a long time-lag between the demonstration of an innovation and its adoption in general practice. As an example the case of budded rubber may be quoted. The advantages of budded rubber were fully realized by many small-holders before the war when they saw the high yields being obtained on estates, but they thought it was beyond their scope to adopt this practice themselves.

It is only now when they can see with their own eyes the results on the holdings of one or two of their less conservative neighbours that they are beginning to realize that they can do the same.

The peasant is also doubtful, not only of the Government servants who attempt to interfere with his way of life, but also of his neighbours with whom he might otherwise profitably co-operate. There is no doubt that co-operative purchasing, marketing and processing of agricultural products would lead to economy of labour and financial profit, but if those who glibly advocate co-operation as the panacea for all the small-holder's troubles would first try to organize a co-operative marketing society there would soon be a fuller appreciation of the difficulties.

The ways in which Government provides assistance to small-holders are most easily summarised under a series of headings.

Padi.

Without the assistance given by the Drainage & Irrigation Department in schemes both large and small the padi planter would be in a very precarious position, and yet this service is more often than not taken for granted. Since the liberation nearly 200,000 acres of padi land have been brought into production, and conditions have been improved over a further 120,000 acres. Where new land is being opened up the colonists are given a subsidy to tide them over until their first harvest, and are also given priority for employment on constructional work in the area; seed for the first crop is free.

Furthermore Government guarantees a price for padi and offers loan facilities for the purchase of draught animals and manures. Seed of improved varieties is also available.

On the investigational side a programme for the further improvement by selection of the most important local varieties is well started. Experiments to test the effect of off-season crops and double padi crops on the fertility of the land are in their second year, and a treatment involving three crops a year is now being incorporated. These are all long term projects.

Experiments in the mechanical cultivation of padi are being undertaken intensively on five different Experiment Stations representing a wide variation in conditions. Two separate problems are involved here, and immediate results cannot be expected. The first is to discover the best and most economical type of tractor; the second is to find out the best time and method of cultivations. There is very little experience in other countries with comparable conditions to guide the course of this work and many setbacks are liable to be encountered. It must be remembered that very heavy capital expenditure will be necessary to provide machinery on a large scale; it would therefore be folly to recommend the first tractor-implement combination which showed promise, only to find two years later that there was something cheaper and more effective. Steady work and patience are

necessary to solve these problems; Government is providing the former, the public is asked to provide the latter.

Annual Crops.

During the occupation all the improved varieties of annual crops, such as tapioca, sweet potatoes and maize, which were introduced before the war were lost. Re-selection is now in quite an advanced stage at the Central Federal Experiment Station, Serdang, and planting material will soon be ready for distribution to local Agricultural Stations where it will be multiplied for the use of the public. In the meantime a range of quite good seed is obtainable from these Stations.

At Cameron Highlands experiments with a large assortment of imported vegetable varieties have already given results and have attracted the attention of local growers. As a result a bulk order for seed is now on its way from America. Improved strains of lowland vegetables are under trial at Serdang.

Rubber.

The Rubber Research Institute has organized, and is rapidly expanding, a small holders' advisory service, the members of which by lectures, talks and demonstrations even in the remotest holdings encourage the adoption of the best methods in all branches of the industry. In many places the local people, particularly young people, are being trained in the art of budding. As an instance of what is being done in this direction the case of Malacca may be quoted. Here in an organized drive partly subsidised by Government, over 10,000 rubber seedlings were successfully budded at a cost of 6 cents each to the owners.

Throughout the country budwood nurseries of the best clones have been laid down in order to supply budwood to the small-holder at the very cheap subsidised rate of 10 cents per yard. It may be asked why this budwood is not given free of charge: the answer is psychological. Experience in many countries has shown that planting material issued free of charge is generally regarded by the recipients as worthless, and no trouble is taken to look after the plants, but if a small payment is made far greater care is exercised. In addition to budwood, nurseries for supplying clonal seedling stumps are now being established in all States and Settlements of the Federation.

On the processing side encouragement, advice, and in some cases smoke-house materials, are given towards the creation of co-operative centres for producing the high-grade sheet which now commands such a good premium, but the response to this activity is very discouraging.

Coconut.

As the result of intensive study before the war a new type of copra kiln in various sizes was evolved to suit the needs of any holding. The copra manufactured in these kilns, which can also be used for drying padi,

is of high quality and the process is rapid. A demonstrator with a portable kiln has recently toured many of the coconut growing districts. The Drainage & Irrigation Department are now tackling the problem of coastal bunds which collapsed during the occupation.

Fruit.

Selection of the best fruit varieties was already well advanced before the war, and most of these selections survived the occupation. As a result fruit tree nurseries are established on all Agricultural Stations and in many places are being expanded to meet a growing demand. Prospective purchasers can come to the Stations during the fruit season and select by tasting them the clones which they like best. The budded trees are sold at subsidised rates.

Poultry.

The time-lag required to build up flocks of imported birds all over the country after the liberation is rapidly drawing to a close, and facilities will soon exist for the supply of pure-bred poultry in every State and Settlement. Small-holders are given preferential rates, but in the case of mature birds prices are necessarily high in order to prevent the immediate resale of a good bird for the table.

Goats.

Stud bucks of three good European milking breeds have now been in the country for nearly a year. At the start these animals were thought by the small-holder to be too large for their own local does, but now that a few cross-bred kids are on view demands for service are increasing. A programme of breeding designed to test the best combination of imported and local blood has been drawn up and is to be carried out at Sungei Udang in Malacca.

Pigs.

Importations of new Middle-White animals were made during 1947: the demand from the public is great, and is being met as rapidly as possible. The provision of stud boars maintained by Government presents many difficulties in that the small rearer is accustomed to having a boar brought to his doorstep, and is unwilling to take his sow to a boar if the distance is more than a few hundred yards. A system whereby the boar is sent for short periods to selected sties in a district is now being organized.

Pest and Disease Control.

Until the present emergency arose the protection of crops from wild pig formed one of the main activities of the Department of Agriculture. Over 2,000 shot guns were imported and were either sold or loaned to small-holders, ammunition in many cases being free; hunts and drives were organized, and tens of thousands of pigs were destroyed.

During the first two decades of the century rats took a heavy toll of the padi crop, but since the introduction of organized measures to deal with these vermin, damage, though not entirely eliminated, is relatively small. In this case the growers have been taught and encouraged to help themselves, supplemented by the issue of free poisons. The introduction in 1947 of a new poison, zinc phosphide, has been a great success.

The majority of small-holders have still not been educated up to reporting the presence of fungus diseases or insect pests, but the field staff of the Department of Agriculture keep on the watch for serious outbreaks which are then dealt with by the appropriate Research Division. As an instance of this type of work it may be mentioned that a serious caterpillar infestation on padi nurseries in Negri Sembilan was successfully overcome. Fundamental research into the incidence of " padi blast " disease is now in progress, and officers of the Soils Division are studying padi crop failures believed to be caused by the presence of arsenic in old mining slimes or mining effluent.

Rural Welfare.

The institution of weekly fairs, sponsored by Government, at many rural centres has made a great contribution to the welfare of the small-holders. This has been further accentuated by the improvement of communications, more particularly by the construction of bridle paths for bicycles. District Agricultural Shows and Padi Competitions, besides stimulating pride and satisfaction in a job well done, provide an opportunity for people from widely separated villages to meet together and discuss the merits or otherwise of the various exhibits both in the prize sections and on the various departmental stalls. In a more roundabout way the cause of village agriculture is also furthered by instruction in the school gardens, by home gardening competitions, by organized conducted tours of Experiment Stations and by the laying down of demonstration plots on small-holders' land.

Publications.

In addition to the widespread work of the Department of Public Relations, the Department of Agriculture publishes agricultural journals in Malay (Jawi), Chinese and Tamil. These journals may be obtained free of charge upon application to the editor. Leaflets dealing with a wide range of crops and related topics are also produced.

Conclusion.

Much could be written to show in detail the vast amount of work that goes on, unadvertised and often unnoticed, both in the Field and Research Branches of the Department of Agriculture, but the foregoing brief summary should serve to dispel the view, if seriously held, that Government takes no practical interest in the agricultural development of the small-holder.

MECHANIZATION

Quarterly Progress Report, July to September, 1948.

Compiled by the Acting Chief Field Officer.

Recent Importations.

(a) *D.2 Caterpillar Diesel Tractor.*

This is the smallest machine in the "D" series and is rated at 25 drawbar h.p.; the wide track model costs $14,800 landed in this country. Costing and performance trials are expected to give some interesting comparisons with the T.D.6 International tractor, but are not yet complete.

(b) *The Field Marshall Tractor.*

This tractor is powered by a single cylinder horizontal diesel of British manufacture and has a higher power than the Fordson Major. It is very solidly constructed, and probably has too high a bearing pressure for work in padi fields, besides being clumsy to turn in the absence of specifically designed implements. It requires two or three men to move the heavy flywheel at starting, but once going it promises to be an economical machine with a three-furrow plough or heavy disc-harrow.

(c) *Other Tractors.*

Two interesting low-powered crawler tractors now undergoing tests are the Bristol and Ransomes' M.G.2. Both are handy machines for operating in small areas as they are very easy on the turn, and the implements supplied with them appear to be satisfactory. The former is fitted with the standard Austin 10 h.p. car engine, the latter with a single cylinder 600 c.c. 4-stroke air-cooled petrol engine: comparative costs and performance should produce some valuable information.

(d) *Killefer Model 35R Panbreaker.*

Promising results are now being obtained with the above machine fitted with the manufacturers' large 1912 K ditcher attachment. Very satisfactory drains have been made with this implement both on a sandy loam at Serdang and on the soft buttery clay at Port Swettenham. It is being used with an H.D.10 wide-gauge tractor. Attempts to adapt it to two D.4's were a failure.

(e) *Miscellaneous Implements.*

Other implements which have been received lately include a range of disc-harrows and special attachments for the Fordson Major power-lift. Among the latter the 3-furrow mould-board plough appears to be too heavy for the machine on most Malayan soils, but is capable of good work when used with only two ploughing units.

(f) *The Tillmor T.28 Spiral Cultivator.*

This cultivator, though it has generally proved rather unsatisfactory on dry land, is nevertheless doing some useful work on wet padi fields in Province Wellesley Central. It cannot, however, be worked at a greater depth than 4 ins. without using a tractor of higher horse power than a Fordson Major. It breaks up the land into small clods which are easily broken down with a light disc-harrow.

Modifications.

(a) *Fordson Major.*

The problem of discovering the best type of wheel for the Fordson Major in wet padi fields continued to engage attention. It was found that, when fitted with the " paddle " wheels mentioned in the last report in this series, the machine lost much of its pulling power but was capable of pulling a single-gang light disc-harrow with a fluted steel Kedah-roll hitched behind the harrow. " Paddle " wheels in the front proved cumbersome; standard front steel wheels with a drum some 6 ins. less in diameter mounted on the axle successfully prevented front sinkage except under very bad conditions. The " paddle " wheels can only be used when there are several inches of water on the land; otherwise they tend to become clogged with mud.

In Province Wellesley the most satisfactory all-round wheel for padi work consists of a plain steel rim with widely spaced transverse 5 ins. angle iron strakes fixed at an angle of 45°; a similar extension rim is attached with its strakes staggered and sloping in the opposite direction.

A further modification for rubber-wheeled Fordsons which has been tried out with promise on sticky clay soil is a system of retractable wheel strakes which can be fitted to the outer wheel hub. They are marketed by S. Berendsen Ltd. under the trade name of " Darvill-Stanhay " strakes.

(b) *Mitchell Seed Drill.*

Large hollow drum wheels were successfully fitted for use on soft peat.

Experiments.

At Bukit Merah in Province Wellesley, yields of off-season Taiwan padi on the depth-of-ploughing experiment showed no difference between land ploughed to 7 to 8 ins. with a Fordson Major and adjoining plots ploughed to 3 to 4 ins. with a B.M.B. Plow-Mate.

At Pulau Gadong in Malacca, cultivations and drilling in the experiment on time and depth of ploughing were successfully carried out in the dry, and irrigation water was subsequently run in. Growth to date is promising, but hand weeding seems to be necessary; weights of weeds from the different treatments are being recorded.

At Chenderong Balai, Sungei Manik, 54 acres of peaty land were prepared by disc-harrows pulled by a modified D.4 or T.D.6. The area was drilled at different rates and spacings, but the stand was so severely thinned by mole crickets and birds that it is most unlikely that reliable indications

as to the optimum spacing will be obtained. On 10 acres which had to be re-drilled, a 5 per cent. mixture of Gammexane and D.D.T. dust appeared to solve the cricket problem.

Experiments on depth and time of ploughing on both wet and dry padi are going ahead well in Kelantan. Some very fine ploughing was accomplished on Kota Bahru Station by both the B.M.B. Plow-Mate and the Trusty; the latter is much easier on the turn than the former, but is slower on the straight. Large crowds gathered and watched the experiments with keen and intelligent interest.

General.

In Province Wellesley, Central, local cultivators are eager to hire Departmental equipment for working their land. It is hoped that some 50 acres, mostly land which has not been ploughed for many years, will be dealt with in this way. The land is either ploughed with a 2-furrow McCormick Deering trailer-plough or is worked with the Tillmor T.28 cultivator; 10 days later it is given a final cultivation with a single-gang disc-harrow followed by a steel Kedah-roll. The all-in charge for this work is $20 per acre, which compares very favourably with $35 which has to be paid for local work.

Abstracts.

REPORT ON POTENTIALITIES FOR THE CULTIVATION OF COCOA IN MALAYA, SARAWAK, AND NORTH BORNEO.

Professor E. E. Cheesman visited Malaya at the end of 1947 at the request of the Secretary of State for the Colonies to investigate the possibilities of cocoa cultivation in the Far Eastern Colonial territories.

Professor Cheeseman, who is now Deputy Director of East Malling Research Station, Kent, was formerly Professor of Botany at the Imperial College of Tropical Agriculture, Trinidad, and is a recognized leading authority on cocoa.

Professor Cheeseman visited Singapore, the Federation of Malaya, Sarawak and North Borneo. He spent nearly the whole of December 1947 in the Federation, visiting Kedah, Perlis, Penang, Province Wellesley, Perak, Selangor, Pahang, Negri Sembilan, Malacca and Johore. After visiting Sarawak and North Borneo he returned to the Federation in February, 1948, and toured Kelantan and Trengganu, and again visited Pahang, finally leaving Malaya early in March.

The Chief Research Officer of the Department of Agriculture, Federation of Malaya, Mr. R. G. H. Wilshaw, accompanied Professor Cheesman throughout his tour of Malaya, Sarawak and North Borneo.

The following are the sections relevant to the Federation of Malaya of the report under the above title prepared and submitted by Professor Cheesman to the Secretary of State.

PART 2. SUMMARY OF CONCLUSIONS.

The potentialities for cocoa cultivation in the Far East are of interest from two distinct though complementary points of view. On the one hand there is already a world shortage of cocoa which is expected to persist for some time and may increase: on the other hand there is a recognized need for diversification of crops in the agricultural development of the territories covered by this survey.

From the first point of view the most important of the three countries visited is the Federation of Malaya, which for several reasons is far better situated to take up a new crop with prospects of rapid development than either of the territories in Borneo. Malaya's population, calculated on total area, is about eight times as dense as that of the Borneo Colonies; and with the denser population the country has well developed communications facilitating the opening of new land. It has a further asset in the interest of plantation companies with both the capital resources and the supervisory staffs to supplement the efforts of its Department of Agriculture in the experimental work necessary in the early stages.

The amount of land apparently first-class for cocoa is not vast, and what there is occurs in rather small and scattered areas; but there is enough in the aggregate to support a respectable amount of cocoa cultivation, and hazarding a very rough guess, I should consider a production of 100,000 tons a year to be well within possibility if the crop once becomes established.

No considerable output can, however, be expected within the next decade, primarily because there is no material available for immediate large-scale planting. This fact is not entirely disadvantageous, since there is much to be learned about cocoa in Malaya before large-scale planting can be recommended. In the first place the suitability of the climate has to be proved by further experiment, and secondly methods of cultivation accepted elsewhere may need modification to fit conditions peculiar to Malaya. The immediate policy must be to combine experimentation with bulking-up of planting material and so to prepare a sound foundation for development.

Cocoa, if established in Malaya, will not interfere with the chief food crop, which is rice, as its requirements are entirely different. As a relatively exacting crop it cannot, unfortunately, be used in the reclamation of poor land injudiciously cleared of forest in the past and now spoiled. It is also unlikely to replace rubber to any great extent, because much of the rubber is planted on soils that would not support profitable cocoa. It may ultimately compete with rubber to some extent for the best of the foothills land already in cultivation: but its chief importance is likely to be as an additional export crop that can be used for the opening of new land without increasing the rubber acreage. Any new land used must be carefully selected to avoid further waste of areas better left in forest, and survey of suitable sites should be commenced early whilst the initial cultural experiments are in progress.

Ultimately, cocoa may well become an important small-holders' crop in Malaya and should be particularly useful as the cash crop basis of land settlement schemes in some of the sparsely populated districts. Until the experimental phase has been successfully completed, however, cocoa cannot be recommended to small farmers, who as a rule have no land to spare for a new crop without sacrificing rubber on which their income largely depends. Furthermore, the successful establishment of " kampong " cocoa will involve either the organization of central fermentaries or the education of numerous small growers in the art of preparation of the beans for sale; and the time will not be ripe for either for a good many years to come.

If estates are to be encouraged to co-operate in experimentation, which to my mind affords the best hope of a reasonably rapid development of the crop, it will be necessary to anticipate a certain demand for new lands when the time comes for extension. Fair apportionment of the limited areas of apparently first-class cocoa land between estates and reserves for small-holder development will therefore demand early attention, which increases the need for early survey of the most promising districts.

PART 3. MALAYA.

Introductory Remarks.

The Malay Peninsula presents general conditions of climate, soils, topography and population sufficiently like those in cocoa-growing regions to justify some hope that the Federation of Malaya may contribute to world supplies of cocoa with benefit to its own agricultural economy. At the same time, the whole complex of factors summed up by the expression "Malayan conditions" has no close parallel in any important cocoa-producing region and the divergences in detail are important enough to qualify the hope as cautious rather than sanguine.

There appears no likelihood that cocoa will become a major crop in Malaya, rivalling either West African production or the local success of rubber. What can be expected is that on a relatively small and carefully selected acreage it may fulfil a useful function by helping to diversify the country's agricultural products. If it is to do even that, efforts must be directed in the first place to establishing the crop on sound lines, by patient enquiry into the best methods of growing cocoa under conditions rather different from those for which experience has already been acquired.

The main theme of this report is therefore experimentation. There is almost everything to be learned about cocoa in Malaya, and learning about a tree crop is not a task of weeks or months. Several years must elapse before the time is ripe for any considerable commercial development.

Emphasis is also laid on the fact that even for experimentation, and still more for commercial planting, the first necessity is an ample supply of good planting material which will take several years to bulk up. A separate section of this Report has been devoted to a discussion of planting material and methods of obtaining it both for Malaya and for the Borneo territories. The view is taken that large introductions from other countries involve risks outweighing their advantages, and for that reason time must be allowed for bulking from small imports.

These conclusions may be disappointing both to those looking for an immediate augmentation of world supplies of cocoa and to those anxious to proceed without delay to diversification of the country's products. But if the pace is forced unduly there may be costly mistakes, and a decade is after all a short time in the agricultural development of a tree-crop country. This Report is not concerned with short-term profits dependent on the length of time that the present price of cocoa is maintained, but is an attempt to assess the place of cocoa in the sound development of Malayan agriculture on long term plans. It is because the prospects for a useful though minor industry appear good that care should be taken not to jeopardize them by impatience.

History and Present Condition of Cocoa in Malaya.

The history of cocoa in Malaya has been summarized by I. H. Burkill in his "Dictionary of the Economic Products of the Malay Peninsula" (1935) from the first mention of the tree as fruiting in a garden in Malacca

in 1778 down to observations by the Agricultural Department at Serdang in 1931. It is a record of numerous small experimental plantings from none of which were there any notable developments; and there is little to be learned from it about the general suitability of Malayan conditions to the crop, since failure may well have been due in most cases to lack of knowledge of the somewhat peculiar requirements of the tree.

A fresh experiment at Serdang, planted in 1934 with particular attention to the provision of adequate shade during establishment, has been described by Faulkner and Milsum in *The Malayan Agricultural Journal* of January, 1938. These trees are now growing well. They are good quality Trinitarios with large pods. Small plots of seedlings from them have been established and are now fruiting on several Agricultural Stations including those in Kuala Lipis and Temerloh in Pahang and Cheras in Selangor. Considering that these progeny plots were planted about 1938 and therefore while still young had to endure several years of complete neglect through the war, they are in surprisingly good condition. Where half the plot has been provided with Gliricidia shade and half left unshaded for comparison, there are in all cases marked differences in favour of the shade. Indeed the unshaded halves are usually dead or moribund, emphasising again the importance of adequate shade during establishment.

The Department of Agriculture has recently made a careful survey of cocoa trees all over the country and Agricultural Officers have located between 200 and 300 trees on private land, mostly as isolated specimens or in groups of two or three in kampongs. They occur in nearly every State of the Federation, but are especially common in Negri Sembilan. I had opportunities of seeing many of these trees during my tour, and was interested in the fact that a high proportion of them are of the old red-podded Venezuelan Criollo variety formerly grown extensively in Ceylon. They are probably descendants of material imported from Ceylon more than 60 years ago. The rest are Trinitarios, variable in colour, size of fruit and quality; these are possibly introductions from Ceylon of a more recent date.

The Department's survey included particular attention to pests and diseases, and many of the trees located by the Agricultural Officers were inspected by the Senior Entomologist and the Acting Senior Plant Pathologist. The reports of these officers show that the major pests and diseases afflicting cocoa elsewhere are not recorded in Malaya, and there appears no particular cause to fear serious losses from the parasites observed during the survey. If cocoa is planted on a considerable scale it will almost certainly develop some pathological troubles which cannot be forecast; but if proper precautions are observed in introduction of new material Malaya should start with great advantages over the older cocoa-growing countries in this respect.

The most serious cause of loss of fruit from existing trees is the squirrel, which is very fond of cocoa seeds and will certainly have to be controlled. Squirrels are a nuisance in all cocoa-growing countries, but

are scarcely to be regarded as a major menace. Their control should prove easier on large blocks of trees than on small groups or isolated specimens.

Climate.

In judging the suitability of the Malayan climate for cocoa, latitude and temperature may be dismissed in a few words. The crop has been grown successfully on the Equator in Ecuador and to nearly 20°N. in the Dominican Republic, with temperature ranges in many districts strictly comparable with those in Malaya.

Where the climate of Malaya as a whole differs from those of the countries now producing cocoa on a commercial scale is in its higher total rainfall and in the absence of any pronounced dry season. In both respects there is so wide a variation over the peninsula that if climate were the chief factor to be considered a number of local climates would have to be studied in some detail. In fact, although the distribution of rainfall in some districts is likely to prove more favourable than that in others, no local climate appears to be wholly unsuitable, and the siting of cocoa cultivation is likely to depend in the first place on soil, topography and accessibility. Brief comment on the broad features mentioned will therefore suffice.

So far as total rainfall is concerned, the mean annual precipitation is over 80 inches at most stations in Malaya, but there is a large number of stations where it does not exceed 100 inches, and 80-100 inches cannot be considered excessive for cocoa although a well-distributed 60-80 inches is probably better. Even 125 inches (a figure exceeded at only a few stations) should not prevent cultivation on suitable soils. There is no doubt that the cocoa tree will tolerate very wet conditions as long as its roots are not waterlogged or subjected to prolonged flooding.

The chief dangers to be apprehended from high rainfall are soil erosion during the establishment of the plantations and excessive humidity under the canopy of the established crop, the latter favouring fungal diseases of several kinds, notably pod-rots and threadblight. Both classes of damage should prove controllable by proper cultural measures, but the methods of countries with lower rainfalls may need modification. For example, the question of optimum planting distance, never yet satisfactorily answered even in the older cocoa-growing countries, will have to be re-examined in Malaya with reference to local conditions and dangers.

The absence of a pronounced dry season may prove to be wholly favourable, as the cocoa tree flourishes best under even conditions of water supply and humidity and on the other hand reacts most unfavourably to violent fluctations in those factors. Yet so little is known about the exact relationships between its flowering and cropping cycle and seasonal changes in the environment that only experiment can show whether cropping is increased or decreased by conditions approaching the optimum for vegetative growth. In other words, it may be necessary for maximum yield that the

trees should experience some check to growth, such as is provided in most countries by a dry season. It is also difficult to forecast the extent to which the more even conditions may tend to spread the fruiting period over the year.

It should be noted that most districts of Malaya do have some relatively dry season, the rainfall graphs showing 3 or 4 consecutive months with an average of about 5 inches a month. The seasonal effect is most marked on the East Coast, where by contrast the rainfall in the monsoon months may rise to 30 inches. Although in Trinidad (and still more in West Africa) three months with five inches a month would be considered a very mild dry season, the fluctuation may be sufficient to suit the fruiting cycle of cocoa. Whatever climatic effects may be found, it has already been demonstrated that the tree will fruit quite well in several parts of the country.

A note should perhaps be added on the influence of weather on the preparation of the crop. The beans, after fermentation, have to be dried and it is generally agreed that sun-drying is preferable to any artificial system. As far as I can gather, the daily distribution of rain and sunshine should not be much less favourable for sun-drying in Malaya than it is in Trinidad; but this is another question for experimental enquiry, because ease of drying must depend much upon the time of year at which the main crop comes in.

Topography, Geology and Soils.

The factor most likely to limit extension of cocoa cultivation in Malaya appears to be the amount of suitable land available for the crop, suitability depending on soil type, topography and accessibility. The Department of Agriculture has a good general knowledge of the soil types occurring in the country, but has never had the staff necessary for a formal soil survey. A rough picture of the distribution of the main soil series is provided by the geological map, but this is incomplete as the Geological Survey is still continuing and the published map is being steadily revised. Consequently only bare outlines can be given here of the features affecting availability of land.

The Malay Peninsula is a mountainous country, rising to more than 7,000 ft. in its highest peaks; and most of the high land, as well as much at lower elevations, consists of steep hillsides, practically no high level flats existing. On both coasts, but rather more on the west than on the east, there are extensive alluvial flats often 10 to 20, and sometimes up to 30, miles wide. Much of the mountainous interior is still inaccessible, and therefore for the purposes of practical agriculture attention has to be concentrated on the coastal plains, the foothills of the main mountain range and certain river valleys.

The geology is very complicated, but the geological map recognizes five main formations, as follows:—

(1) *Limestone and calcareous shales and other Raub Series rocks.* These are the oldest rocks in Malaya, being of Carboniferous age, and occur chiefly in a strip running north and south down the centre of the peninsula. This strip forms a slight trough between the western and eastern ridges of the main range, which is traversed by the railway line from Gemas to Kota Bahru, the only line of communication through the mountainous core of the country.

(2) *Pahang Volcanic Series.* These are igneous intrusions of various ages and ranging from acidic to basic in constitution. They occur in scattered, usually small, patches over most of the peninsula and not only in Pahang.

(3) *Quartzite and shales.* These rocks, of Triassic age, occur generally in ridges parallel to the granite and on both sides of it.

(4) *Granite and allied very acid rocks of post-Triassic age.* These form two " spines " in the main range. The major granite mass runs almost due south from the middle of the Siamese border to reach the west coast in Malacca; a secondary and roughly parallel mass lies to the east in Kelantan and Trengganu. Granite rocks at lower elevation occur also in the tip of the peninsula in Johore and form part of the island of Singapore.

(5) *Coast deposits and alluvium.* These cover the flat areas on both coasts and extend across the centre of Johore.

Corresponding to the geological formations an equal number of main soil groups can be recognized and referred to briefly as Raub, Pahang volcanic, quartzite, granite and alluvial soils. Although the limestone outcrops are included geologically in the Raub Series of rocks, the Raub soils are not as a rule calcareous, and being derived from shales they much resemble the quartzite soils in many properties, including that of tending to form a band of so-called " laterite " at a certain distance below the surface. On a very broad classification they can be grouped with the quartzite soils, and as the Pahang volcanic soils are of small extent we have then three main groups of soils to consider as covering practically the whole country—the granite, the quartzite and Raub, and the alluvial.

J. H. Dennett (Studies in Malayan Soils. *Malayan Agricultural Journal* 21 (1933) pp. 347-61) has usefully pointed out that nearly all Malayan inland soils, whether derived from granite or from quartzite or Raub rocks, are of open texture and very free draining—so much so that on hillsides lack of retentive power for water may cause all the effects of drought in spite of high rainfall. On the coastal alluvial soils, which are largely clays, the problem is often reversed and successful crop production depends much on sufficient drainage to get rid of excess water. This distinction is of such importance in connection with the prospects for cocoa (a tree needing free drainage as much as any) that alluvial soils will be discussed separately here. It is in the foothills that the prospects appear brightest, and therefore the inland soils are more important and will be taken first.

Of the inland soils, the best in all respects occur in the Pahang Volcanic Series, unfortunately narrowly limited in area. Pahang Volcanic rocks as recognized by the goelogists vary widely and not all of them weather down to good soils, but the best give deep uniform soils with a relatively high potash and phosphate content, and these could be planted to almost any crop with confidence. Obviously they should be reserved for crops of high value, and cocoa is one such. Good clones might be expected to approach a yield of a ton of dry cocoa per acre on these soils, unless some overlooked deficiency is discovered, and at that rate even 50,000 acres would make a useful contribution to world markets.

The only igneous rocks other than the Pahang Volcanic are the granites, which are abundant but very variable. The quality of the granite soils seems to depend largely on the grain of the parent rocks and soils derived from the finer-grained granites are little if at all inferior to the Pahang Volcanic. Even the coarser-grained granites give some very good soils, especially in places where decomposing rock occurs a few feet below the surface. They consist of free-draining mixtures of sand and clay in which the quantities of available plant nutrients are not high but may be maintained at an adequate level by continued decomposition of the underlying rock. Deep granitic sands from which the nutrients have been washed out are naturally poor soils, and all gradations occur, so that only a fraction of the granite soils can be classified as first-class for cocoa.

The Raub and quartzite soils, derived from a heterogeneous series of sandstones, shales and schists, are extremely variable—often even within small areas. They include some fairly good samples as well as a lot of really poor ones; but in general their content of mineral nutrients is low and I judge that only on the very best of them would cocoa crop profitably without manures. Whilst there is no general difference between the two series, the best of the Raub soils are rather better than the best of the quartzites, and a few of them may be almost first class, but it is safer to regard them as second-class cocoa soils. The poorer types in each group are useless for cocoa, though they often produce paying crops of rubber; they are unfortunately very much more abundant than the good.

Broadly, then, the best prospects for cocoa cultivation are on the soils derived from igneous rock, and particularly on those derived from the finer-grained igneous rocks. The area of such soils available is limited not only by the amount of the parent rocks but by topography. The granite rocks which give most of the better soils are associated too often with the steepest country, and it is only where the right soil type is associated with rolling country of reasonably gentle slopes that I should expect anything like a cocoa-growing district to be developed. Elsewhere, suitable soils may occur in small patches.

Steep slopes if previously cleared of forest are bound to be partially eroded, and even if they are freshly cleared for cocoa planting they are apt to be eroded before the trees are large enough to protect them. Very steep

slopes are also unfavourable for the tending of the trees and harvesting of the pods. Similar considerations of course apply to most tree crops in the wet tropics. In practice all of them (including cocoa) are often planted on slopes that would be much better left under natural forest. The degree of slope that can justifiably be cleared and planted depends so much on the amount of care taken and the anti-erosion methods adopted that it is always open to argument. It may be stated with some confidence, however, that attempts to plant cocoa on slopes as steep as some of those that now carry rubber in Malaya are unlikely to give satisfactory results; because cocoa is a more exacting crop in its requirements and much less tolerant of the degree of erosion that is almost inevitable. The lower and gentler slopes must therefore be selected, and where there are valleys between hillsides, where wash from the higher slopes has accumulated good soil, the best conditions of all are likely to be found. Valleys are also good as providing the protection from wind which is very important for success with cocoa; and in this connexion it should be mentioned that not only strong winds are detrimental, but even breezes. A gentle air movement, sufficient to prevent the excessive humidity that would develop in still air, is beneficial; but some form of windbreak must be provided against breezes strong enough to have a drying effect on the leaves.

I am not able as a result of a rapid tour of the country to assess the total area of first and second class cocoa land that might ultimately be available. When the requirements of soil type and topography have been met, the areas within accessible districts are evidently not enormous. Bearing in mind, however, that a very useful quantity of cocoa might be produced off less than a quarter of a million acres, I am satisfied that there is enough to justify experimentation and serious attempts to establish the crop in Malaya. Attention should be concentrated in the first place on the best lands, where the costs of production will be lowest. Once the crop is established, its subsequent extension will depend on world markets; and if demand is maintained, cocoa cultivation may be found profitable on soils that at present I regard as marginal.

The possibilities of cocoa cultivation on the alluvial soils may be regarded as a fit subject for experimentation at a later date, but less promising than the possibilities on the best foothills soils. There is in fact not one question to be answered here, but several; for there are considerable differences between the coastal alluvium of the west coast, the coastal alluvium of the east coast, and the river-bank alluvium of some of the east coast rivers. Of the three, the levees along the banks of some of the east coast rivers in their middle reaches might come high on the list for trial if it were desired to extend cocoa cultivation beyond the foothills regions, as they present conditions not unlike those in Ecuador and as a smallholder's crop the tree might do well on them. The main alluvial plains of

these rivers, above the level subject to frequent or prolonged flooding, might (where not too sandy) support cocoa as one element in a mixed agriculture which provided organic manure for the trees.

The west coast alluvium presents special problems, being largely composed of heavy clays with a high water-table. In general, this land is probably most suitable for rice cultivation, but some estates have large areas of rubber on it and are interested in cocoa as a possible alternative tree crop. There are theoretical arguments both for and against the likelihood of success with cocoa, and I have had no experience of conditions sufficiently closely similar to afford a safe guide to recommendations.

Dennett (*loc. cit.*) says: "The coastal alluvium can be regarded as the richest soil in Malaya but owing to heavy texture its drainage is restricted." According to most generally accepted theory the second part of this statement is enough to rule out cocoa, which certainly prefers soils of open texture and free drainage. Yet cocoa has sometimes been grown profitably on heavy clays where the drainage was adequate and the soils were not subject to any severe periodical drying out. Given the richness of the soil, the important question is the adequacy of the drainage, and it may be adequate although restricted.

In northern Perak I examined some profile pits which were full of water from recent rains. When they were baled out, subsoil water poured through crevices at 2 ft. and lower. The top 2 ft. however was crumbly in texture, full of roots and clearly not usually water-logged, whilst the line of the permanent water-table was a foot deeper. This was a case of restricted drainage, but the important factor seemed to be that the subsoil water was moving. Remembering that Amazonian Forastero cacao, at least, is a riverside species tolerating occasional flooding of short duration, one is tempted to think that 2 ft. of rich soil with moving fresh water below may well be sufficient for it. At one site on the Sungei Bernam a Criollo tree was growing vigorously a few feet away from a pit into which water poured at 1 ft. 6 ins. and which showed only 1 ft. clear above the mottled zone indicating fluctuating water table.

The most nearly comparable conditions in the older cocoa-growing countries are probably in Surinam, a country with which I am not familiar. The comparison is not encouraging, as the history of cocoa in Surinam is not a happy one. It is arguable, however, whether failure there was due more to Witches' Broom disease or to soil conditions; and it is also arguable whether the soils, though equally low-lying are equally rich if compared with the Malayan alluvium.

On balance I can only say that a small experiment on the alluvial clays would cost little and would have a fair chance of proving profitable, though I should deprecate any extensive planting in these unorthodox conditions without careful preliminary trial. This conclusion applies only to clays with a high content of organic matter, and does not extend to the peat soils which are also common along the west coast.

Cocoa in General Relation to Malayan Agriculture.

The parts of Malaya most developed agriculturally are the lowlands of the west coast, the foothills behind them on the western side of the central mountain mass and at its southern end, and the rolling country in the tip of the peninsula. This area is divided politically between Perlis, Kedah, Penang and Province Wellesley, Perak, Selangor, Negri Sembilan, Malacca and Johore. The smaller of these units are relatively uniformly developed, whilst the larger extend inland into the mountainous country and include large areas of forest. On the east coast there is a concentration of population and some intensive agriculture on the coastal plain in the extreme north-east, round Kota Bahru; but with this exception the three large States of Kelantan, Trengganu and Pahang are relatively undeveloped.

The western coastal plain is largely occupied by wet padi where the soil and topography are suitable, but also grows large areas of coconuts and the ubiquitous rubber. The foothills cultivation is almost entirely rubber as far as cash crops are concerned, but " kampong agriculture " (the growing of fruit trees and other food crops round the dwellings) is universal.

It is desirable at this stage to enquire how cocoa, as a cash crop additional or partly alternative to rubber, is likely to fit into the established pattern. The possible impacts of the new crop on rubber estate cultivation and on kampong agriculture are discussed separately, but it seems to me, putting the matter in the broadest terms, that cocoa is likely to be more useful in the development of new areas than in diversification of crops in the districts already planted up. Its requirements being what they are, it will not, or should not, anywhere compete with the chief food crop, which is wet padi. A conclusion less satisfactory from some points of view is that it cannot replace any considerable areas of existing rubber.

Although in the course of my tour I have seen many fields planted with rubber that would almost certainly grow good cocoa, they do not amount in the aggregate to more than a very small fraction of the rubber acreage; and they are, quite naturally, the best of the rubber. The vast majority of rubber lands, including practically all on the quartzite soils, appear to me quite unlikely to give profitable yields of cocoa, at least without heavy manuring on a scale that has never been adopted for the crop. On the other hand there are, in districts relatively easily accessible but not yet intensively planted, areas of granite and volcanic soils as promising as the best of the rubber lands.

The proportion of unalienated jungle land (Forest Reserves and State lands) in the whole country is probably more than 80 per cent. This figure, of course, bears little relation to the exploitable reserves, because it is made up very largely of steep mountain sides and includes swamp and other unusable formations. Nevertheless it must also include quite a respectable aggregate area which can, with due precautions based on knowledge of soil

type and slope, be opened up for cocoa or any other tree crop whenever the time is ripe.

The importance of precautions is illustrated by the large areas of " spoiled " land that already exist, especially in the State of Johore, where jungle has been felled and the land, after its accumulated humus layer has been exploited and lost, has been allowed to go to lalang. Cocoa cannot use this spoiled land, and it is very important that no more should be ruined in the search for suitable cocoa land under virgin jungle. From this point of view it is perhaps fortunate that shortage of planting material will enforce a careful policy for the next few years. The experimental phase of cocoa planting in Malaya can be carried through on small areas, many of which can be obtained by sacrificing relatively minute amounts of good rubber, and while it is in progress there will be time to consider carefully what new lands may desirably be opened up.

Cocoa in Relation to Rubber Estates.

The prevalence of estate cultivation by commercial companies with good capital resources is a big factor in Malayan agriculture and a very important one to be reckoned with in assessing the possibilities of a cocoa-growing industry. Although the bulk of the world's cocoa is in fact grown by small farmers, there is no doubt that the crop lends itself perfectly well to estate cultivation, and in its establishment as a new crop in Malaya the capital resources of the companies are likely to make for speedier progress than would be possible if it were entirely a small-holders' concern. The advantage of company participation lies especially in the greater facilities for experimentation that thereby become available, and one has only to compare the level of technique reached in rubber cultivation with that at present prevailing in cocoa cultivation to realize the contribution that capitalist growers have made to the development of the former.

The estate companies in Malaya are quite definitely interested in cocoa as a possible adjunct to rubber, wishing to diversify their interests as some insurance against the risks of dependence on a single market. The high yielding power of modern rubber clones is a factor in the situation, aggravating the danger of over-production if the areas under rubber are increased or even maintained at their present size and completely replanted.

There is, however, a natural tendency to look for a crop, whether cocoa or another, that can be used to replace the poorer and less productive rubber, so reducing the production costs of the rubber itself by confining it to the most profitable areas. I feel that this Report should place it emphatically on record that such an outlook must seriously prejudice chances of success so far as cocoa is concerned. Rubber is itself one of the most tolerant of the major tree crops, and few things are likely to give good returns on soils where rubber will not, climatic conditions being suitable for it. Cocoa is certainly not one of them. The question about which the planter has to satisfy himself by experiment is not whether his poorer rubber land

will grow cocoa but whether his best lands will return him more profit under rubber or under cocoa.

The lands which rubber companies would be willing to plant experimentally in cocoa immediately if planting material were available fall mainly into two classes. Some are areas of old rubber planted before about 1920 and due for replacement by clones or clonal seed if not by an alternative crop. Others are areas that have been cleared either of jungle or of rubber some years ago but never planted or replanted as the case may be; these include large tracts felled by the Japanese for food production, and while some that have simply been cleared now carry secondary bush those that have carried food crops for several years are mostly in sheet lalang. The suitability of such areas for cocoa depends of course on the soil in each case and no sweeping assertions can be made. General considerations suggest, however, that land which has carried rubber for nearly thirty years, and was probably clean-weeded in its early history until badly sheet-eroded, is unlikely to be good for cocoa unless it was very good in the first place. Such lalang-covered clearings as I was able to inspect were all poor and could not be recommended even for experiment.

Next to the suitability of their available lands, rubber planters are interested in the extent to which cocoa and rubber could be planted together. Many have said that for ease of tapping they wish to try " avenue planting," i.e. planting the rubber trees thickly in the row but in rows wide apart, thus retaining approximately the same number of trees per acre as on a square plant but reducing the number of tapping lanes to be kept clear. Knowing that cocoa is commonly grown under shade, they wonder whether the widely spaced rubber rows would provide the necessary shade for interplanted cocoa without the use of other shade trees.

As this is something outside my experience, I can only regard it as another question to be answered by experiment. In the only case where I had previously seen rubber and cocoa interplanted (in Trinidad) the cocoa failed: but towards the end of the present tour, in Ceylon, I saw mixed fields where the cocoa seemed quite healthy and the rubber was said to benefit from its presence.

On general principles, rubber has the appearance of being a bad neighbour for cocoa. In the first place its shade is too dense; and widening the spacing will only give larger unshaded patches, whereas the ideal is a dappled shade over the whole field such as is cast by a spreading thin-crowned tree. In the second place there is root competition to be remembered; and rubber roots are particularly aggressive, as can be demonstrated by digging a hole anywhere in any rubber field.

To deal with another question in parenthesis, it is for these reasons that I regard any attempt to establish cocoa under old rubber as foredoomed to failure or at best to only partial success. It is a pity that it should be so, in view of the great convenience that the method would afford if feasible. The convenience may justify experiment, which in turn may prove my

opinion wrong. But I urge that in the early stages of experimentation, when planting material is bound to be scarce, it should be given a fair chance of establishment on more conventional lines; that is, on clear-felled land with bananas and other suitable plants for ground shade and specially planted trees of a selected species for permanent shade.

Returning to the question of interplanting which is distinct from that of establishing young cocoa under old rubber, I believe that it might prove feasible on the better soils, provided that neither the rubber nor the cocoa were expected to give the same return as it would with the other species absent. It might be that with side protection afforded by thick lines of rubber at least 45 ft. apart the cocoa could be grown without permanent overhead shade (it must have ground shade such as bananas when young) and utilize the middle 15 ft. strip of the avenue at least until the rubber got too big. In considering whether such a method would be more or less profitable than growing the two crops in larger alternating blocks there are so many factors to be weighed that only experiment can provide the answer. My own preference would certainly be for larger blocks of each species by itself, based on the consideration that their manurial requirements as well as their light requirements are entirely different.

The overweighing argument in the interplanting question, however, is likely to be given by the discovery that only a small fraction of existing rubber land is suitable for cocoa, interplanted or not. At the risk of tedium it must be emphasized that cocoa is likely to compete in profitability with rubber only on the best soils. It should therefore be tried on the best lands first and given every opportunity. If it succeeds there, experience will discover which soils are marginal for its profitable cultivation and how far it can be integrated with rubber cultivation. The opposite approach, subordinating its requirements to the interests of the rubber from the first, can lead to nothing but disappointment.

The relatively exacting nature of cocoa leads to one more conclusion that may interest planting companies, and that is that the profitable unit of cultivation is likely to be much smaller than those to which they are accustomed. Good soils often occur in small patches or pockets, and it will probably be found that blocks of more than a thousand acres all suitable for cocoa are rare. Smaller blocks of a few hundred acres can, however, be worked quite profitably on estate lines; and such units, perhaps with rubber on the poorer lands between them, are likely to suit the distribution of soil types in most parts of Malaya where cocoa can be grown at all.

Cocoa in Relation to Kampong Agriculture.

Cocoa has in many countries proved a useful crop for the small farmer, and if it is to take its place among the products of Malaya one important question will be how far it can be integrated with Malayan kampong agriculture.

The Malay small-holder has as a rule his padi plot on some suitable flat, which according to the district may be quite near his house or at some distance, and immediately round his dwelling he grows a mixture of economic tree species, usually including coconuts and various fruit trees. Beyond the latter he often has 2 or 3 acres of rubber. Apart from those on Agricultural Experiment Stations, all the cocoa trees existing in the country today are in the kampongs round the houses, where the shade of the mixed fruit tree species and a general manuring with house refuse provide good conditions for their growth.

The number of such kampong trees could easily be increased until in the aggregate they amounted to a considerable acreage, but the advantage to their owners would depend entirely on facilities for disposing of small crops. Half a dozen or a dozen trees would be of no value whatever, unless there were a market for fresh pods at some near-by central fermentary, because the bulk of beans available at one picking would be insufficient for proper fermentation even by the methods used for small lots. They could be sweated after a fashion, to give a low quality product; but if Malaya wished to establish and maintain a reputation for well fermented cocoa, the small-holder would have to be encouraged either to grow at least 2 or 3 acres of cocoa or to sell his wet beans to central fermentaries for treatment in bulk; and with a very low number of trees per grower central fermentaries could hardly be made to pay.

The obstacle to any immediate development of kampong cocoa (apart from the universal shortage of planting material in the country) would appear to be lack of land. The Malay small-holder (at least on the west coast) has all his land occupied, and as far as I could determine by enquiry has no conscious need of an extra cash crop. To grow cocoa he would have to cut down rubber, destroying his chief source of income for several years, and even if cocoa were already an established product of the country it is doubtful if he would be well advised to make the change. Rubber is an almost ideal crop for him: it needs very little attention at any time and can be left without any at all while he is busy attending to his padi. Cocoa has to be picked when ripe, and protected from squirrels and rats, and although needing little pruning or weeding nevertheless demands more tree care than rubber if it is to be kept healthy.

Once the possibilities of cocoa in Malaya have been studied experimentally and are understood, the tree might play an important part as the cash crop basis of new land settlements in the sparsely populated areas. This is a contingency that the Department of Agriculture will doubtless keep in mind when planning its experimental programme with the crop. The replacement of existing kampong rubber by kampong cocoa would appear to be a much more remote contingency: and without replacement I do not see any room for kampong cocoa in the more densely populated districts.

The Need for Cultural Experiments.

After the selection of soils and sites, the questions that arise in cocoa planting include the variety to be planted, the spacing of the trees, the method of establishment and the provision of shade. Many other questions arise later, but spacing, establishment and shade are fundamental and to some extent interlocked. The varietal question is discussed in a separate section.

Broadly speaking, cocoa can be grown by either of two general methods. The trees may be planted at wide spacing (12 ft. or more) and provided with permanent shade trees, which is the traditional system; or they may be planted close (8 ft. or less), which is the West African system, with or without a certain amount of permanent shade. The two systems have never yet been compared by properly controlled experiments. Close planting is now beginning to be tried in Trinidad, because it has the obvious advantages of tending to early production and of lowering costs by suppression of weed growth between the trees. Experiment has not yet proved that these advantages are not outweighed by disadvantages among which is the high cost of close planting if vegetatively propagated trees of selected clones are used.

While discussion about spacing goes on in the older cocoa-growing countries, it is obviously impossible to offer definite advice to Malaya on the method to be adopted under untried conditions. This therefore is one of the subjects that will need experimental enquiry at an early stage. As long as planting material is scarce, however, there are strong arguments in favour of planting the earliest trials by the traditional system. This not only needs a much smaller number of trees per acre, but for a very wet climate it may have the further advantage of providing conditions within the plantation less favourable to pod rots and threadblight. It may be significant that the close planting system originated in the cocoa region having the lowest rainfall.

Employment of the traditional system, however, raises the question of the species to be used for permanent shade. My opinion against the use of *Hevea brasiliensis* for this purpose has been given above, but is not emphatic enough to rule out experiment with some of the lighter-crowned clones. The West Indian anauca immortel (*Erythrina poeppigiana*) does not appear to be in the country, and in general *Erythrina* spp. do not flourish in Malaya. *Albizzia* spp. would be ideal shade if they were not, as I am informed, brittle and therefore liable to damage the crop. The Rain Tree (*Enterolobium Saman*) is rather slow growing, but is an excellent shade when established and well worth trial as it does well in the country. There is a wide field for experimentation with local species of spreading light-crowned habit. For the earliest trials of cocoa it may be best to use *Albizzia*, which seems likely to be good enough for the first ten years, giving time for further trials to mature.

The question of establishment is largely independent of those of spacing and permanent shade, and much more vitally important. Whatever its later history is to be, cocoa must have shade and protection when young; and possibly more failures in Malaya are traceable to ignorance of this fact than to any other cause. In all the older cocoa countries the young trees are raised among mixed food crops, called in the West Indies "ground shade." The principles to be observed are: (1) to provide the young cocoa with some overhead shade until the permanent shade trees are old enough to function, or until the cocoa trees themselves form a continuous canopy at close spacing, (2) to provide lateral protection against air movement, and (3) to cover the soil and maintain a cool moist atmosphere around the young trees.

The first function is adequately fulfilled by bananas, which can be used in Malaya as they are elsewhere. Incidentally this seems an appropriate place to mention that the banana can be regarded as a good indicator plant for the success of cocoa. If the planter finds that he cannot establish a good healthy stand of banana plants to protect his young cocoa, he may as well save himself the expense of planting the cocoa. My opinion of the unsuitability of many Malayan soils for cocoa is based partly on observation of the bananas, which quite generally in this country are not nearly so healthy and luxuriant as they should be. Premature senescence of leaves is very common, and the whole appearance of the plants suggests an insufficient supply of potash or perhaps some other mineral nutrient. Even wild bananas only grow well in restricted localities, which I believe to be largely those on the better granite soils. The use of bananas in the establishment of cocoa may therefore serve a double purpose, as if they grow they will provide the ideal temporary shade and if they do not grow their failure will be a warning of the unsuitability of the site.

The other functions of "ground shade" are ideally fulfilled by certain African and West Indian food crops, and incidentally their use in all the older cocoa countries materially reduces the cost of establishing cocoa. There may even be a profit from the field before the cocoa begins to bear. Unfortunately there is in Malaya no demand for the best of them, such as the edible Colocasia species and pigeon peas (*Cajanus indicus*). Some other suitable low-growing species will therefore have to be used, and it may be difficult to find any that give a cash return, in which case perhaps *Tephrosia*, *Indigofera*, or some other erect cover crop may be utilized—again a question for experiment. Creeping covers are not suitable, as they do not provide necessary lateral protection and are apt to smother the young cocoa.

One general note on experimentation may perhaps be added here to prevent any possible misunderstanding. The term is used throughout this Report in a very broad sense, and is not meant to imply elaborate field experiments planned for statistical analysis. Such experiments are, indeed very difficult to carry out with tree crops, and so far as they are necessary

to answer some important questions in cocoa cultivation generally they are best left to the research stations specializing in the crop. To find out how well cocoa will grow in various parts of Malaya, approximately how far apart the trees should be planted, and what species can be utilized as shade trees, requires a number of simple trials on a small scale but in many different places, and observation of the results will fairly quickly provide enough information for the avoidance of mistakes on a bigger scale when commercial planting begins.

The Varietal Question.

Broadly speaking, there are three classes of cocoa in the world's markets: " Ordinary ", represented by the production of West Africa, Brazil and the Dominican Republic; " Fine ", represented by the cocoas of Trinidad, Grenada, Ecuador and several smaller producers including Ceylon and Java; and " Criollo " usually included among the " Fine " but in reality a separate and very special class with a small demand and an even smaller supply. Leaving aside the last as of interest only to a few estates with the best possible conditions the main question for discussing here is whether Malaya should plant an " Ordinary " or a " Fine " cocoa, using the term " Fine " as synonymous with the Trinitario cocoas of Trinidad, Ceylon, Java and some other countries.

The issue is not a straight one between a low quality and a high quality product. In fact, the cocoas grouped as " Fine " are very various, and some of them are intrinsically little if any better in quality than " Ordinary ", though they may have certain qualities making them desirable to the buyer in limited quantities. The issue is rather between two different botanical groups, and it involves more than intrinsic quality.

" Ordinary " cocoa, so far as it means that grown most widely in West Africa and Brazil, is the product of trees classified botanically as Amazonian Forasteros. These are rather uniform in type and reasonably vigorous and productive. The quality of the cocoa varies with the preparation it receives, but is " ordinary " in the sense that, however well prepared, the beans never develop the flavour and aroma characteristic of some of the " fine " grades.

" Fine " cocoas in practice are nearly all the product of trees classified botanically as Trinitarios, Trinitario being not a varietal name in any usual sense but a name for a mixture of extremely diverse elements. The quality of a Trinitario cocoa is therefore the quality of a natural mixture, or blend, and the quality of the constituent elements varies from very high to very low. The complicating factor is that in the mixture of trees that constitutes a Trinitario population there is also wide variation in yielding power, just as there is in seedling rubber. It happens to be among these cocoas that most has been done in selection and propagation of high-yielding clones; but there has not yet been time to determine the quality of individual clones, which may be entirely different from the quality of the mixture from

which they are isolated. It is therefore quite possible that while some of them may command a quality premium, others may fall commercially into the " ordinary " grade, yet be more profitable to the grower than an Amazonian Forastero because higher yielding.

The expected shortage is chiefly of " Ordinary " cocoa, and as there is an expressed demand for this by the chocolate manufacturers and an assured market for it, an Amazonian Forastero type should certainly be included in the experimental programme in Malaya. At the same time the yielding power of certain selected Trinitario clones is so promising that they equally certainly should not be omitted. Furthermore, it may be expected that if Malaya takes up cocoa-growing the country will in time evolve its own type, adapted to the local conditions. The surest way of evolving a really successful type is to start with a sufficiently wide range of variation upon which local selection can work. The history of rubber proves that Malaya can carry out selection and clonal propagation, and whereas in a less developed country it might be better to start with a single type suitable for multiplication by seed alone, here it will be good policy to begin early the exploration of a range of types and the trial of advanced techniques such as propagation by cuttings.

Whilst the study of varieties, directed toward selection of the best for Malayan conditions, cannot begin too soon, the hard facts of the situation dictate that nearly all the early experimental work will have to be carried out with the material at present available on the Experiment Stations of the Department of Agriculture. Most of this is fairly uniform and it may be called for brevity the " Serdang type." It is a Trinitario, apparently of good quality and by no means to be despised as a commercial stock. For the next year or two, practically every seed will be required for experimental plantings and bulking up, but as soon as there is material to spare steps should be taken to prepare commercial samples to be submitted to manufacturers for their opinions about the quality. If this type proves acceptable, extensive commercial planting may be possible several years sooner than if it has to wait for bulking up of introduced material: but no great extension should be undertaken without a report on quality.

Recommendations.

The prospects for cocoa growing in Malaya appear sufficiently good to justify expenditure on serious attempts to establish the crop on a commercial scale. If it is to be established soundly, however, the attempts must begin with a programme of experimental investigation designed to confirm the findings of this preliminary survey of possibilities.

The time spent in experimentation will not be lost, because available supplies of planting material are quite inadequate for immediate commercial planting. Introduction of large quantities of seed from other countries is highly undesirable, and time must therefore be allowed for bulking up from existing Malayan stocks and from small introductions. This bulking up

must take at least five years, and it may be ten years before the supply of planting material is abundant.

Policy for the next five years or so should therefore be aimed at two objectives—production of the maximum quantity of seed and acquisition of the maximum amount of information about the behaviour of cocoa in Malaya. The two aims are not entirely consistent, but may be most nearly reached by planting a large number of small plots in different districts and under different conditions of establishment. These plots will provide much information, if well chosen, and will also serve as nurseries for the supply of seed when they come into bearing. To meet the latter objective, however, it is obviously necessary to restrict experimentation in the first place to the more promising soils and to methods of establishment that are known to give good results in other countries. Material cannot be spared in the early stages for " long shots " such as attempts to establish cocoa under old rubber.

In all this early experimental work and bulking of supplies the co-operation of planters is clearly essential, as the labour involved is far beyond the resources of an under-staffed Department of Agriculture already loaded with work on established major crops. The function of the Department should be to co-ordinate the effort and the results achieved, and in order to co-ordinate efficiently the Department will have to control the supply and distribution of planting material, ensuring its best use in the common interest.

Immediate steps should be taken to conserve the supplies of seed of the " Serdang " type from trees on the Department's Experiment Stations and to guide it into the channels where it is most likely to be put to good use.

Early steps should be taken for the importation, under careful quarantine conditions, of seed from West Africa and seed and budwood from Trinidad. In this matter, however, the Cocoa Research Committee in London should be consulted before any direct action is taken by the Department of Agriculture in Malaya. As North Borneo and Sarawak are also in need of cocoa introductions, the Committee may find it desirable to formulate a single scheme for the supply of material to all the territories concerned, enlisting the co-operation of the West African Cocoa Research Institute and the Imperial College of Tropical Agriculture.

Circumstances dictate that the early experiments and the first commercial plantings must be made almost entirely with seedlings, but the advantages of clonal propagation will doubtless be kept in mind from the beginning, and it is advisable that experiments in propagation from cuttings should be started early, so that when vegetative material of I.C.S. clones can be obtained from the West Indies it can be bulked up for distribution. It may also be worth while propagating the best of the Serdang trees as clones.

In view of the preoccupations of the Department of Agriculture with the problems of rice, coconuts, pineapples, oil palms, tea and other crops, it is highly desirable that an additional research officer, either agriculturist or botanist, with some experience of cocoa, should be appointed to keep in touch with cocoa experiments generally and to supervise bulking of introduced material both by seed and vegetatively.

Simultaneously it is necessary for the Department to acquire more information about the distribution of suitable cocoa soils, which is only one aspect of the need for a soil survey in Malaya. I recommend therefore the appointment of an additional soils chemist whose first duty should be the plotting of soils in the more accessible districts deemed generally favourable for cocoa-growing and who would also be able to advise on the suitability of sites selected for commercial planting.

PART 6. THE SUPPLY OF PLANTING MATERIAL.

The supply of planting material for all three of the territories with which this Report is concerned is a matter of great importance and urgency, because there is very little available in Malaya and practically none at all in Borneo. Getting even preliminary experiments under way depends on a good supply of young trees, a single 5-acre experimental planting needing 1,500.

The introduction of planting material from other countries is necessary, if only because the few trees in Malaya are undesirably restricted in their range of variation. The risks of introducing at the same time some major pest or disease of the cocoa tree are however very grave, unless careful precautions are adopted. If these territories can develop cocoa-growing as an important industry, a big factor in their success will be that they start free of the major maladies afflicting the crop in West Africa, the West Indies and elsewhere; and other considerations such as the speed with which they can work up a large production, must be subordinated to ensuring that happy state of affairs.

With proper scientific control there need be no risk involved in the introduction of small quantities of material from anywhere. Bulk importation of large quantities of cocoa pods or seeds is another matter, which no plant pathologist would guarantee to be entirely safe in any circumstances, and which from certain countries would be very dangerous indeed. It has to be remembered however, that the biggest risk of all lies in material imported unofficially and illegally, and whilst there can be no absolute protection, this risk may be reduced by making legally imported supplies abundant as quickly as possible. In this region, special precautions are necessary against introductions from Java, which has a serious pest in the Cocoa Moth (*Acrocercops cramerella Sn.*).

In balancing risks and arriving at a reasonable figure for the amount of material to be imported the following data may be used:

(i) A cocoa pod irrespective of variety contains very roughly 30-40 seeds; and therefore, with care, at least 25 seedlings should be raised from one pod.

(ii) A seedling tree, well treated with a view to early bearing, should produce ten pods when five years old and larger numbers in succeeding years.

(iii) Each acre planted requires 300 trees.

Thus, each original pod (if material is not wasted by unsuitable treatment) should provide seeds for planting at least 20 acres a year after the fifth year. A rate of planting of 20,000 acres a year over the whole region, beginning in 1953, would require that 1,000 pods should be available this year, and that all the seeds should be used for planting seed nurseries. I imagine that more than 1,000 pods will be harvested in 1948 from the trees on agricultural Experiment Stations in Malaya, so that if bulking up were the only immediate requirement no problem would arise. Importation will still be necessary, however, partly because a great deal of the Malayan material is required for experimental plantings that cannot be expected to give maximum seed yields, and still more for the sake of getting in a selection of desirable varieties.

The rough calculation shows that necessary imports may be reckoned in hundreds rather than thousands of pods, but even hundreds involve some risks and thousands would be entirely out of the question. There is therefore, in my opinion, no possibility whatever of any large-scale planting before 1953 unless very grave risks are to be taken. The safe policy is to rely on local bulking of carefully controlled small introductions.

The possible sources of planting material to be considered are:

(i) The trees already in Malaya.

(ii) Ceylon.

(iii) West Africa.

(iv) The West Indies (Trinidad).

The trees already in Malaya are of two classes. There are numerous Venezuelan Criollo (white-seeded) trees scattered in kampongs throughout the country, and there are Trinitario trees of good quality at the Central Experiment Station at Serdang and on other Stations of the Department of Agriculture.

The Criollo material is of limited usefulness. It is a super-quality cocoa, but a rather delicate tree and probably a light yielder. In view of the definite though small demand for Criollo cocoa at a high price, however, and considering how well it is bearing in some kampongs, I believe this cocoa should prove a highly profitable crop for perhaps two or three estates favourably situated on a good volcanic soil. A comparison of a few hundred trees of the type with an equal number of Serdang seedlings might be made on one of the Experiment Stations and should prove useful as well as interesting. It is at the very least worth preserving as a pure type, now almost extinct in its native country, and useful for breeding purposes if

not directly as commercial cocoa. My fear is that if the Criollo is generally used as experimental material it may give misleading results by returning only a poor yield where a more vigorous cocoa would be quite profitable. On the other hand it may have some value in testing sites and methods on the understanding that where it succeeds any of the hardier cocoas would do so.

The Serdang material is very promising, and has the advantage that some yield records are available for the trees planted in 1934 on which a selection can be made of the best performers. These may then be used as seed parents, and it may be worth while in Malaya to propagate two or three of the best as clones. The operation will at least provide practice and experience in clonal propagation, either by cuttings or by budding on seedling stocks raised from the poorer bearers. In one way and another maximum use should be made of the Serdang trees and their progeny at Cheras and elsewhere, because this is the only material available for immediate planting of preliminary experiments and it is quite good enough to give useful information.

Ceylon as a source of seed has the advantage that it is, as far as known, free of the major pests and diseases that might be introduced to Malaya. Some fairly large importations (about 24,000 seeds, estimated to give 15,000 plants) have already been made by private enterprise through the Department of Agriculture, Malaya, which has provided quarantine precautions by an isolation plot in jungle near Serdang. While regarding the present arrangements as safe, I do not think they should be overstrained by attempts to handle any larger quantities.

The possibilities of further large-scale introduction from Ceylon appeared to me sufficiently important to require examination on the spot, and with the approval of the Government of Ceylon I paid that country a visit on the homeward journey and was given every assistance by the Ceylon Department of Agriculture and local planters.

Ceylon cocoa is a Trinitario mixture very similar to the mixture grown in Trinidad, though of slightly higher average quality. There is every reason to suppose that variation in yielding power between individual trees is as great as in Trinidad cocoa, and that this variation reduces the average productiveness of the population just as it does in Trinidad. Careful selection and vegetative propagation would doubtless result in the isolation of highly productive clones, but they have not yet been carried out in Ceylon. "Selected" material such as has already been obtained for Malaya by private enterprise consists of open-pollinated pods from trees marked on certain estates as heavy bearers. It does not appear that the selection has been done on scientific principles, and in particular no correction of yield for size of tree seems to have been made. All Trinidad experience suggests that the performance of the progeny is likely to be disappointing and its average yield relatively low.

The general usefulness and desirability of the seed material obtainable from Ceylon therefore does not justify the taking of risks in introduction of large quantities, and although it is true that neither Witches' Broom disease nor Swollen Shoot is known in the country, I am not entirely satisfied that no other risks are involved.

The large number of supplies in Ceylon cocoa fields shows that the annual mortality of the trees is high, and general opinion attributes the losses to Canker. I saw a few trees dying of what looked like a more virulent disease than that I have known as Canker in Trinidad, and though the malady is unlikely to be seed-borne it is important enough to call for careful watching. I also noticed a pod-boring larva new to me and potentially destructive: this would be most unlikely to pass inspecting pathologists, but its occurrence illustrates the vital importance of control and inspection of imports, which can only be carried out satisfactorily on small quantities.

In introducing material from West Africa the great risk is the introduction of the Swollen Shoot viruses, which would wreck the Malayan industry before it started. I believe the risk can be nullified, and the importance of getting a known productive and acceptable kind of cocoa into Malaya is sufficient to justify some expense in doing so. Introduction should, however, only be made if the West African Cocoa Research Institute considers it safe and can arrange for pods to be forwarded by a competent pathologist from a district suitably distant from any known infection of Swollen Shoot. I understand that such districts can be found in the Cameroons. Material sent should be limited to a small consignment (250 pods would seem a reasonable maximum) and it goes without saying that it must be delivered to a Department of Agriculture.

Trinidad has both Witches' Broom and a virus disease against which precautions must be taken, but in the I.C.S. clones selected by the Imperial College of Tropical Agriculture it also has some of the most promising material available anywhere. Introduction should be perfectly safe if consignment is arranged by I.C.T.A. and may take the form of both pods and budwood. " Clonal seed " can be sent from I.C.S. clones growing far from any virus infection, and the risk of introducing Witches' Broom by seeds is nil if competent pathologists are employed. Budwood can be obtained from a disease-free nursery established some time ago in St. Vincent, B.W.I.

There will be technical difficulties about introductions from West Africa and the West Indies on account of the fact that both seeds and budwood lose viability rather quickly. Special travelling arrangements may be necessary for the officers who are to collect material from the safe localities and get it quickly on to main-line airways, and the safest way to avoid delays in the more remote districts is for the collector to travel with the material.

Transport by main-line air services may be effected in two ways. The material may be either spread over a series of small consignments or sent in one lot. The first method obviously reduces the risk of losing a large amount of material if anything goes wrong, but involves heavy expense and a great deal of trouble at the collecting end. In the long run it would probably prove cheaper, and certainly be more economical of research officers' time, to move all the material from Trinidad in one consignment and all that from West Africa in another, with a competent officer travelling with each consignment to ensure its proper treatment. Experiments in methods of packing are already in progress both in Malaya and in Trinidad which may be expected to find a suitable technique; but my own opinion is that the loss of viability often experienced with transported material is due either to delays or to conditions created by the protective packing necessary on unaccompanied material. As it is easily possible to get material from Port of Spain to Kuala Lumpur in less than 10 days, I can see no reason why accompanied material should not travel perfectly well without any special packing, since pods will keep longer than that on a laboratory bench in the tropics.

At the receiving end there are manifest advantages to be had from confining introductions of planting material to one channel for all the territories concerned; and in view of the fact that the Federation of Malaya alone possesses a specialist staff I recommend that arrangements be made for the Department of Agriculture there to accept responsibility for all introductions and for the forwarding of a fair proportion to Sarawak and North Borneo.

To avoid lengthening the journey for seeds or budwood, the forwarded material might be germinated seedlings or propagated plants. But in present circumstances, with communications as they are in the Borneo Colonies, it would be much safer for the Malayan Department to retain all original introduced material and do the necessary bulking-up on an area of first class soil under the eye of a competent officer. The other Departments have neither good sites near their headquarters nor officers to spare for frequent visits to the places where their best soils occur, and with their restricted facilities there would be inevitable wastage of expensive material.

The obvious objection to bulking-up in Malaya is that Sarawak and North Borneo will have to wait five years for West African or West Indian material and will lose the opportunity of beginning at once to acquire experience with it. This objection may be partly overcome by letting them have immediately a small supply of "Serdang" seed for experimental planting, from which they can acquire experience of cocoa as a species. The arrangement is not ideal, but in existing circumstances I see little hope of getting direct introductions from West Africa or Trinidad established in Sarawak or North Borneo without heavy wastage.

IMPLEMENTATION OF THE RECOMMENDATIONS OF THE CHEESMAN REPORT

The following are extracts from a memorandum by Dr. A. E. S. McIntosh, Acting Director of Agriculture, submitted to Government commenting on Professor Cheesman's Report as far as it concerns the Federation of Malaya, detailing the steps which are being taken to implement the recommendations made, and showing the actual achievements to date.

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3. The recommendations in Professor Cheesman's Report are in general accepted. They can most conveniently be divided into the following five categories:—

(1) Field Investigations.
(2) Bulking of Existing *Serdang* Type.
(3) Soil Survey and Assessment of Suitable Land.
(4) Introduction of Planting Material.
(5) Provision of Planting Material for Borneo and Sarawak.

These are considered seriatim.

(1) Field Investigations.

4. Within Malaya this category may be subdivided into "Departmental" and "Estates."

5. With reference to the latter, the value of estate co-operation in the early phases of the work is fully recognised in that it meets the wishes for experimentation in cacao growing of many estates in Malaya while at the same time and with suitable co-operation between the Department and the estates concerned with regard to type of material and methods of planting and soil conditions for planting, many questions will be answered with regard to the factors on which information is required. Finally, and very important too, these experimental plantings will serve to bulk the *Serdang* type material. The Department has already invited the co-operation of estates. Briefly, for the supply of planting material and the giving of advice in connection with the selection of suitable sites and planting methods to be adopted (the latter being embodied in a cyclostyled pamphlet), the estates undertake to observe planting on selected sites and to carry out planting and cultivation by the methods recommended. It is to be observed that in this phase of the work selections are only made under estate conditions where soils are considered suitable. In general the experimental block size under these conditions is five acres although some estates are sufficiently sanguine of success, on their own responsibility to plant a much

larger acreage; in one case some 100 acres being employed for the purpose. Under this scheme some thirty-six estates have signified their intention to plant or have actually planted in accordance with the scheme. These estates are scattered over all States/Settlements in the Federation with the exception of Trengganu and the Settlement of Penang and Province Wellesley.

6. Under the head "Departmental", the work in this category is essentially more experimental in that it seeks to carry out work of testing cocoa growth on a wide range of soil types and carrying out variety and propagation trials, work which estates could not be expected to undertake. These undertakings can be classified as follows:—

(a) Bulking cum spacing experiments with the *Serdang* type under soil conditions not at all or at most little represented in the commercial plantings indicated in the previous paragraph.

(b) Experimentation to test *criollo* type vs. *Serdang* type on good soils.

(c) The planting of a pure stand of *criollo* type under good soil conditions calculated to indicate how this type performs under such conditions and at the same time to provide planting material for commercial plantings in the event of the experiment indicated in (b) and at the same time world market demands suggesting that commercial planting of this type is warranted.

(d) Cacao propagation experiments.

(e) Breeding and selection work.

(f) To prepare when possible a bulk sample of the *Serdang* type for submission to the United Kingdom for a report on quality by manufacturers.

7. With reference to actual implementation to-date of this work arising out of Professor Cheesman's recommendations, the position is as follows:—

Para. 6(a) above. A list of Agricultural Stations for the purpose has been drawn up and it was the intention that these Stations should be visited for a final selection of five Stations to carry at each plantings of five-acre blocks. This work has been temporarily suspended in view of the shortage of staff to fill duty posts and secondments for work arising out of the present emergency.

Para. 6(b) and 6(c) above. Negotiations are being made with the Government of Trengganu and the Malay Agricultural Officer-in-charge of Trengganu enquiring as to the possibility of acquiring 100 acres of land of considered eminently suitable soil for cacao and the practicability of laying down on such soils two experimental blocks of five acres each in the first place, these two blocks to serve respectively for experiments noted under paras. 6(b) and 6(c) above.

Para. 6(d) above. Experimentation in all aspects of cacao propagation work is already being undertaken at the Central Federal Experiment Station, Serdang, the technique of experimentation being based largely on work already done in this respect, chiefly in Trinidad.

Para. 6(e) above. Under this section the Botanical Division has put up a standardised method for recording the performances of existing individual trees of the *Serdang* type at the several Stations where it is being grown with a view eventually to making clonal selections from existing material.

Para. 6(f) above. The preparation of a bulk sample of the *Serdang* type for submission to the United Kingdom manufacturers will be attended to when the necessity for using seed produced from the existing plantings for planting experimental blocks on estates and Departmental Stations disappears.

(2) Bulking of Existing 'Serdang' Type.

8. Plantings of the *Serdang* type, this type being the Malayan representative of the *trinitario* type, occur at the Central Federal Experiment Station, Serdang, and the State Agricultural Stations of Cheras, Selangor, and Temerloh, Pahang. Seeds derived from the trees on these Stations are being used for issue to estates which are co-operating in the early investigational work, vide para. 5 above. It is expected that some 150 acres may thus be planted by April, 1949, and it is estimated that such an acreage would yield by 1954, provided gowth is reasonable, enough planting material of the *Serdang* type to plant some 20,000 acres. Further it is estimated that by 1963, an area of some 200,000 acres could be in bearing and this area, assuming a yield of one half ton of dry beans per acre, could provide some 100,000 tons of dry beans; this being the amount which Professor Cheesman has tentatively estimated might be economically produced by Malaya.

(3) Soil Survey and Assessment of Suitable Land.

9. Preliminary allocation of estate experimental blocks referred to in para. 5 above so far has had to be carried out on the broad available knowledge of the soils of Malaya. Any extensive developments of the cacao industry on the right soil types to embrace an envisaged approximate 200,000 acres, would, it can well be imagined, necessitate extensive soil surveys, more particularly in land which has not yet been brought into cultivation from virgin forest. This is properly a function of the Soils Chemistry Division of the Research Branch of this Department but, whereas provision on the Establishment exists for four posts of Soils Chemists, in actual fact there are at present only two Soils Chemists. These two officers are concerned in work of high priority directed towards surveying the soil conditions in potential padi land within the scheme submitted to Government by the Drainage & Irrigation Department. Consequently no Soils Chemists are

available to undertake work under this category and Professor Cheesman in his Report has quite properly indicated the necessity for the appointment of a Soils Chemist.

(4) Introduction of Planting Material.

10. The principle of importation of a limited quantity of planting material principally from the British West Indies and West Africa under the most strict control is fully agreed to.

(5) Provision of Planting Material for Borneo and Sarawak.

12. This is referable at this stage (i.e. prior to importation) to the *Serdang* type only now existing in the Federation.

13. With regard to action taken under this category, I have to state that requests have been received from the Director of Agriculture, Sarawak, and these requests have already been fulfilled by the despatch of seeds by air to the Director.

14. The Director of Agriculture, North Borneo, has been invited to make requests for a similar type of planting material, but from information received to-day from the Director of Agriculture, North Borneo, it appears that the Secretary of State has advised him to delay importing planting material from Malaya until proper quarantine facilities are available in Malaya.

Notes and Comments.

RICE CROP, SEASON 1947-48.

Record Production.

Statistics published elsewhere in this issue show that total rice production in the 1947-48 season amounted to 343,065 tons, of which 341,759 tons represented the main crop, and 1,306 tons the off-season crop.

This total creates a record for Malayan rice production, exceeding the previous highest figure of 342,150 tons in 1935-36, and far exceeding the post-war crops of 1945-46 and 1946-47, which were 225,044 and 257,164 tons respectively.

The planted acreage of 881,304 acres was also a record, the previous highest total being 820,480 acres in 1940-41. Separate figures are published for the first time for this season showing the actual acreage harvested, from which it will be seen that slightly over 40,000 acres were not harvested. This loss was almost entirely due to the heavy rains and flooding experienced at the end of 1947.

A fuller report will be published in the issue of this Journal for January 1949.

RUBBER STATISTICS HANDBOOK, 1947.

The latest edition of this annual handbook gives valuable statistics of the Malayan rubber industry, both for 1947 and previous years. It covers acreages, production, imports and exports, stocks, and prices. The book is divided into three main sections providing complete pan-Malayan statistics, and certain separate information for the Federation of Malaya and for Singapore.

Production in 1947 reached the record total of 646,362 tons. In 1940, with an average release of 83¾ per cent. for the year under Rubber Regulation, production was 547,202 lbs., while for the period January to October 1941, for which statistics are available, production totalled 498,975 tons with 100 per cent. release.

Gross exports in 1947 totalled 953,688 tons, far exceeding the previous record of 772,767 tons in 1940.

The Handbook is published by the Department of Statistics, Federation of Malaya, Kuala Lumpur, from whom it can be purchased at $4 post free in Malaya.

MANILA HEMP.

A recent trade report received from London on samples of locally grown Manila hemp indicates that they were equal to Philippine Islands' Davao "S2" Grade, valued at about £145 to £150 per ton delivered buyers in the United Kingdom.

Departmental.

FROM THE DISTRICTS

Compiled by the Acting Chief Field Officer from Monthly Reports of Agricultural Officers.

June, July and August, 1948.

The Weather.

Rainfall was below average in the north-west, west, and in parts of Pahang, but the reverse conditions prevailed in the south accompanied by some flooding; in Kelantan there was more rain than usual for the time of the year.

Crop Reports.

PADI.

1947-1948 Season. With the completion of harvesting on the Selangor coast in July, the 1947-48 season came to a close: it is estimated to have produced the record crop of 343,065 tons of rice, including 1,306 tons from the off-season crops.

Off-season Crops. Approximately 1,500 acres were planted to short term Taiwan varieties in Province Wellesley, South Kedah and Penang; the area was severely restricted by the dry weather. Yields ranging from 100 to 500 gantangs per acre were obtained, the latter figure being recorded in Penang. Double cropping also took place in west Pahang where yields averaged approximately 200 gantangs per acre.

1948-1949 Season. In Kedah and Province Wellesley North dry weather interfered with cultivation and the crop is up to a month later than usual in many places. By the end of August transplanting was general throughout Krian where prospects so far may be considered good. In Kelantan unseasonal rain hampered the cultivation and planting of many dry padi areas and it is probable that some will not be planted, while germination on others is poor. On the wet lands work is well in hand. On the Selangor coast, shortage of water held up work except on the irrigated areas at Sawah Sempadan and Sungei Burong. In Negri Sembilan the very early planting dates adopted have not led to the expected early harvest because, being planted out of season, the plants have delayed flowering. Conditions in Malacca and Johore were good on the whole and satisfactory progress was made, but parts of Pahang suffered from dry weather after transplanting.

FOODCROPS AND VEGETABLES.

1,000 piculs of maize are reported to have been harvested in the Sekinchang area on the Selangor coast, and the area planted in other States, particularly on the east coast, was well up to average both as regards acreage and yield.

In areas where foodcrops are grown in rotation with padi, harvesting of the former was almost complete by the end of August.

Vegetable production at Cameron Highlands averaged 600 tons per month; of the 700 tons produced in August, 500 tons were transported by rail from Tapah Road. Opening up of the Tringkop valley went ahead rapidly.

RUBBER.

The wide difference in price between high and low grade sheet tended to increase rather than diminish during the period under review. There was some evidence to show that the significance of this fact is gradually being appreciated by small-holders, but with so many obstacles to overcome, progress towards a general improvement in quality is inevitably slow.

During the second quarter 5,202 yards of budwood were supplied to small-holders. New legal plantings since the liberation totalling 1,250 acres have been visited by the small-holders' advisory staff; all of this has been or will be budded. Of small-holding rubber felled during the occupation over 4,000 acres have now been replanted, and of this area 404 acres are already budded.

During August a scheme to supply clonal seedling stumps to small-holders was developed and some of the nurseries had already been sown by the end of the month.

COCONUTS.

The market for copra and whole nuts fluctuated widely and by no means uniformly in different parts of the Federation. Improvements in maintenance of holdings took place in several western districts. On the east side of the Peninsula three new copra kilns were erected. A survey of small holdings was conducted in Johore.

FRUIT.

With the exception of Kedah where record crops were harvested, the mid-year season was generally well below average, but flowering for the Christmas crop is very promising.

PINEAPPLES.

The fruit season reached its peak in June with supplies of fruit in excess of the estimated crop; as a result the pack-quota was increased to 100,000 cases. Good burns were obtained on new land in Pontian, and large-scale planting was started. It is difficult to obtain accurate information owing to the emergency, but it is thought that 2,500 acres of new land will have been planted by the end of the year.

CASHEW NUT.

A heavy crop was harvested in Trengganu in June. A sample of nuts from Kuantan was sent to South India for report. In external appearance the nuts were similar to those grown in the main commercial areas of India,

but the quality of the kernels was poor, probably on account of bad harvesting methods. A further sample will be sent now that the best harvesting technique is known.

Agricultural Stations.

Vegetables.—Successful trials with imported varieties have been carried out during the last year at Cameron Highlands, and as a result there has been a heavy demand for seed of the best proved strains. A bulk order for re-sale to local growers has already been placed with an American firm.

Citrus.—The Habu Station at Cameron Highlands has now been brought back into good cultural condition and the trees are already showing improved growth; many of them are now fruiting. At Gajah Mati a half acre plot of young budded grapefruit is making very promising growth, and progress at Degong is also encouraging. Experience to date indicates that pomelo (*C. maxima*) and " limau Hantu " (*C. macroptera*) are likely to prove the best stocks for the plains.

Rubber.—Budding of nurseries for supplying budwood to small-holders was in full swing all over the country.

Maintenance.—The Howard " Gem " rotary hoe is proving invaluable in general maintenance work; costs of cultivation and weeding have been considerably reduced.

Livestock.—Now that initial diffidence is breaking down among local goat keepers, demands for services by pure-bred stud bucks are increasing.

The demand for Middle-White pure-bred boars and gilts from Cameron Highlands continues in excess of the supply. In Malacca Middle-White sows which were reluctant to come on heat showed an immediate response to an injection of 1 cc. of Stiboestrol Dipropionade.

Miscellaneous.

Pests.—The emergency has interfered with the shooting of wild pig, but in spite of this over 10,000 were killed during June, July and August.

The campaign against rats in the padi areas was intensified through the off-season and during cultural operations. Reports from most States indicate a distinct scarcity of this pest at present, but it is still too early to prophesy that damage will be negligible.

DEPARTMENTAL NOTES

Retirement of Mr. T. D. Marsh, N. D. A.

Mr. T. D. Marsh, Senior Agricultural Officer, (Research), left Malaya on leave prior to retirement on the 31st July, 1948.

"Tom", as he is affectionately known to his numerous friends, arrived in Malaya in October, 1921, as an Agricultural Assistant. Born and trained in England he had taken up an appointment with the Department of Agriculture, Western Australia, in 1912. After overseas service with the Australian Imperial Forces in Egypt and France, he returned to Western Australia to become Farm Manager and Instructor in Agricultural Science at the Narrogin School of Agriculture, and became Acting Principal in 1920.

His early training and experience in the Western Australian Farm School developed in him a strong practical outlook in agricultural matters and provided valuable experience in animal husbandry in which field he became an acknowledged local authority. The many investigations which he conducted in Malaya, particularly in the feeding, care and breeding of cattle, pigs and goats, and his supervision of the model dairy farms at the Central Experiment Station, Serdang, and at Fraser's Hill, have been of immense value, not only to the peasant small-holder but to local dairy enterprise.

He was, for some years, in charge of the Government Plantation, Teluk Anson, but later took charge of a Division of the Central Experiment Station, Serdang. In 1939 he was appointed Senior Agriculturist and assumed full charge of this Station.

His close acquaintance with the varied aspects of local agriculture, gained during the years spent at Serdang, resulted in many calls for his advice on diverse problems being received from estates, Agricultural Stations and the general public, and he was always prominently associated with the Agricultural Section of the annual Malayan Exhibition.

Following the invasion and occupation of the country by the Japanese in 1941-42 he was interned, with many of his Departmental colleagues, in the Civil Internment Camps in Singapore where his practical knowledge of cultivation of local food crops was put to very good use.

As a keen member of the Volunteer Forces his skill with the Lewis gun and rifle earned him a place in many of the Selangor Battalion's teams as well as a number of trophies.

It is particularly fortunate that many of the records of his pre-war investigations in agriculture and animal husbandry were recovered on liberation, and also that he was able to return to Malaya, although overdue for normal retirement, to place his valuable knowledge and experience at the disposal of the country during the period of rehabilitation, in the new

post of Senior Agricultural Officer (Research).

His colleagues and other friends extend to him and to Mrs. Marsh their best wishes for happiness in retirement.

A. T.

Leave.

Mr. E. J. H. Berwick, Agricultural Officer, returned from leave on 21st August, 1948, and assumed duty as State Agricultural Officer, Selangor, with effect from 24th August, 1948.

Mr. D. G. Jones, Agricultural Officer, returned from leave on 24th August, 1948, and assumed duty as Agricultural Officer, Central Experiment Station, Serdang, with effect from 25th August, 1948.

Mr. P. G. Coleman, Agricultural Officer, returned from leave on 14th September, 1948, and assumed duty as Agricultural Officer, Food Production, with effect from 16th September, 1948.

Mr. R. W. R. Miller, Agricultural Officer, seconded to Sarawak, has been granted 110 days leave, in addition to voyages, with effect from 13th May, 1948.

Mr. A. L. Barcroft, Agricultural Officer, has been granted 190 days leave, in addition to voyages, with effect from 16th August, 1948.

Retirement.

Mr. T. D. Marsh, Senior Agricultural Officer, (Research), proceeded on leave prior to retirement on 31st July, 1948.

Mr. F. S. Banfield, Horticultural Officer, proceeded on leave prior to retirement on 1st October, 1948.

Statistical

MARKET PRICES

July to September 1948.

Rubber.—During July the Singapore price of No. 1 R.S.S. Spot loose made a gradual advance from 46⅜ cents per lb. on the 1st to 48¾ cents on the 30th, giving an average of 47.90 cents for the month. In the first week of August, this improved price remained steady but fell to 43¾ cents on the 16th August advancing slightly towards the end of the month to 45 cents on the 31st, the average price for August being 45.76 cents. There was little movement in prices during September, but the average price for the month fell to 44.45 cents per lb.

The average prices paid in London and New York were: London, July 14.72, August 13.60 and September 13.08 pence per lb.: New York, July 24.22, August 23.56, and September 22.96 cents gold per lb.

The average prices for small-holders' rubber at three centres during the third quarter of 1948 are given below in Table I.

Table I.

Average Monthly Price Paid by Local Dealers for Small-Holders' Rubber, July-September, 1948.

(Dollars per picul of 133⅓ lbs.)

Grades	Kuala Kangsar, Perak.			Seremban Negri Sembilan.			Batu Pahat, Johore.		
	July	Aug.	Sept.	July	Aug.	Sept.	July	Aug.	Sept.
Smoked Sheet ..	57.87	54.32	52.40	58.24	55.17	53.25	49.15	46.10	46.94
Unsmoked Sheet ..	49.42	46.22	44.40	49.30	47.02	42.87	44.29	43.74	43.04
Scrap ..	29.00	24.00	22.20	21.00	17.75	15.50	16.80	17.06	14.12

Transport from Batu Pahat to Singapore by lorry, excluding duty, 80 cents to $1 per picul.

Tea.—The latest Colombo prices available quoted from the "The Ceylon Tea Market Report" of 21st September, 1948, of the Colombo Brokers' Association, are as follows, in rupees per lb.:—High Grown Teas Rs. 1.81, Medium Grown Teas Rs. 1.58, Low Grown Teas Rs. 1.54.

There is, in addition to the above prices, an export duty of 38 rupee cents per lb. which is payable by the buyer.

The retail price of Malayan tea (Boh) is $2 per lb.

Derris.—A rapid advance in price took place in July, from $67-$69 to $71-$73 per picul in August, for root of 5% rotenone content delivered loose into Singapore godown, representing the largest increase since April this year when United Kingdom manufacturers re-entered the market.

Rice.—The Government controlled price of rice remains at $30 per picul. The ration was 2½ katis per week per person during July, but increased to 3 katis per week per person at the beginning of August.

Padi.—The Government guaranteed price of padi delivered at the mill is $15 per picul and for padi purchased in the field $14.20.

Tobacco.—The market price of No. 1 cured leaf in Kelantan showed a decrease in July to $455-$505 per picul, remaining the same for August, but falling still further in September to $400-$500 per picul. The prices of 2nd and 3rd quality were, respectively: July, $320 to $450 and $190 to $310; August, $320 to $450 and $200 to $300; September, $300 to $380 and $200 to $280.

Table II.

Singapore Prices of Various Agricultural Products.

Product	September, 1948			August 1948	July 1948	Average Price 1947
	Highest	Lowest	Average	Average	Average	
	per picul $	per picul $	per picul $	per picul $	per picul $	per picul $
Copra:						
Sundried No. 1 ..	35.00	32.50	33.77	38.77	42.54	21.28
Coconut Oil ..	63.00	61.00	61.65	68.33	74.27	35.49
Coffee:						
Padang Bali No. 1	120.00	120.00	120.00	120.23	123.00	109.10
Palembang No. 1	75.00	58.00	69.12	75.08	76.69	65.13
Sourabaya No. 1	82.00	74.00	79.23	82.15	84.69	79.15
Pepper:						
Muntok White ..	228.00	192.00	206.92	207.12	189.81	124.65
Sarawak ..	227.00	191.00	205.92	206.12	188.81	116.85
Cloves:						
Indian ..	44.00	44.00	44.00	44.00	44.00	41.85
Sumatra ..	47.00	47.00	47.00	47.00	47.00	51.70
Gambier: —						
Rounds No. 1 ..	125.00	125.00	125.00	125.00	125.00	130.81
Sago Flour:						
Lingga ..	21.00	19.50	20.15	20.35	21.12	16.25
Tapioca Flour:						
Malayan No. 1 ..	30.00	30.00	30.00	30.00	30.00	28.15

FEDERATION OF MALAYA
PRODUCTION OF PALM OIL AND KERNELS.

(In long tons as declared by Estates)

Month	Palm Oil		Palm Kernels	
	1947	1948	1947	1948
January ..	2,238.2	3,821.9	292.3	664.1
February ..	2,316.9	3,659.8	337.1	677.9
March ..	2,585.8	3,567.6	386.2	633.0
April ..	2,410.2	3,598.6	380.2	699.4
May ..	2,377.7	3,076.5	359.9	597.4
June ..	2,451.2	2,420.1	336.1	431.0
July ..	3,479.4	3,245.5	452.6	564.9
August ..	3,558.5	3,617.8	551.0	690.2
September ..	3,887.3		583.1	
October ..	4,465.0		635.9	
November ..	4,483.9		658.4	
December ..	4,860.9		764.4	
Total ..	39,115.0	27,007.8	5,737.2	4,957.9

In August, 38 estates (planted area 73,408 acres) were in production out of a total of 47 oil palm estates (planted area 78,665 acres).

MALAYAN AGRICULTURAL EXPORTS, APRIL-JUNE, 1948.

Product	Net Exports in Tons.				
	Year 1947	Jan.-June 1947	Jan.-June 1948	April-June 1947	April-June 1948
Arecanuts	12,507	3,459	449	812	1,725
Coconuts fresh†‡ ..	62,873†	26,916†	27,008†	20,126†	15,347†
Coconut oil‡	41,112	19,271	21,319	8,767	9,435
Copra‡	45,439*	20,821*	24,314*	12,974*	10,197*
Copra cake	5,260*	2,709*	2,687*	1,683*	2,052*
Gambier, all kinds ..	1,156	660	112	438	118
Palm kernels	5,245	1,956	3,913	1,019	2,464
Palm Oil	43,325	21,689	23,993	5,601	11,700
Pineapples, canned ..	2,611	548	1,488	65	514
Rubber¶	645,229¶	310,859¶	347,685¶	149,504¶	176,609¶
Sago,—flour	5,958	131*	3,371*	57	1,456*
„ —pearl	2,404	3,803	5,949	1,827	4,194
„ —raw	6,415*	4,137*	1,238*	1,750*	1,001*
Tapioca,—flake	52	26	93	7*	77
„ —flour	6,490	5,045	698*	2,533	686*
„ —pearl	7,205	3,405	6,448	2,843	4,798
Derris	243	223	42	50	13
‡Copra equivalent ..	22,625	11,033	10,869	1,675	5,442

† hundreds in number. * net imports. ¶ production (Federation of Malaya).

FEDERATION OF MALAYA PADI STATISTICS.

Area of Land Planted and Harvested, and Yields of Padi. Season 1947-1948.

State/ Settlement	WET				DRY				TOTAL WET AND DRY PADI		
	Area Planted	Area Harvested	Yield (Gantangs) (000's)	Average Yield (Gantangs per acre)	Area Planted	Area Harvested	Yield (Gantangs) (000's)	Average Yield (Gantangs per acre)	Area Planted	Area Harvested	Yield (Gantangs) (000's)
Perlis ..	42,010	38,055	12,788	303	37	37	5	141	42,047	38,092	12,793
Kedah ..	257,890	253,691	80,892	314	5,980	5,980	512	86	263,870	259,671	81,404
Kelantan ..	138,106	134,240	34,891	260	29,994	29,994	4,571	152	168,100	164,234	39,462
Trengganu ..	38,480	37,734	6,477	172	15,406	14,096	1,527	108	53,886	51,830	8,004
Penang & P. Wellesley..	39,584	39,507	12,951	328	2,539	2,266	214	94	42,123	41,773	13,165
Perak ..	119,664	111,290	28,648	257	18,097	18,030	1,927	107	137,761	129,320	30,575
Selangor ..	38,453	34,920	7,699	220	5,630	5,100	430	84	44,083	40,020	8,129
Pahang ..	44,266	32,624	6,694	205	2,405	2,405	173	72	46,671	35,029	6,867
N. Sembilan ..	33,283	33,034	9,432	286	49	49	2	31	33,332	33,083	9,434
Malacca ..	32,357	32,357	5,031	155	85	85	12	136	32,442	32,442	5,043
Johore ..	15,058	13,958	2,002	143	1,931	1,700	139	82	16,989	15,658	2,141
Total ..	799,151	761,410	207,505	273	82,153	79,742	9,512	119	881,304	841,152	217,017
Off-Season Crop	3,578	3,578	818	229	602	138	11	76	4,180	3,716	829
Total 1947-1948	802,729	764,988	208,323	272	82,755	79,880	9,523	119	885,484	844,868	217,846
Total 1946-1947	732,614	—	162,376	222	80,924	—	8,896	110	813,538	—	171,272

Notes:—1. Yield to the nearest 1,000 gantangs.

2. For 1946-47 separate figures for acreages harvested were not recorded.

RICE EQUIVALENT 1947-48 = 343,065 tons (for details see next page).

1946-47 = 257,164 tons.

1945-46 = 225,044 tons.

FEDERATION OF MALAYA PADI STATISTICS.

Off-Season Padi. 1947-1948.

State/ Settlement	WET				DRY				TOTAL WET AND DRY PADI		
	Area Planted	Area Harvested	Yield (Gantangs)	Average Yield (Gantangs per acre)	Area Planted	Area Harvested	Yield (Gantangs)	Average Yield (Gantangs per acre)	Area Planted	Area Harvested	Yield (Gantangs)
Kelantan ..	585	585	269,000	460	—	—	—	—	585	585	269,000
Penang & P. Wellesley..	1,581	1,581	338,000	214	504	40	5,000	130	2,085	1,621	343,000
Perak ..	25	25	3,000	125	—	—	—	—	25	25	3,000
Pahang ..	1,100	1,100	176,000	160	80	80	5,000	61	1,180	1,180	181,000
N. Sembilan ..	55	55	5,000	95	18	18	1,000	25	73	73	6,000
Johore ..	232	232	27,000	116	—	—	—	—	232	232	27,000
Total ..	3,578	3,578	818,000	229	602	138	11,000	76	4,180	3,716	829,000

Rice Production.		Gantangs Padi.			Tons Rice.	
Main Crop	Wet	207,505,000		= Wet	326,780	
	Dry	9,512,000	217,017,000	= Dry	14,979	341,759
Off-season Crop			829,000	=		1,306
Total ..			217,846,000	=		343,065

Conversion Rate: 635 gantangs padi = 1 ton rice. (i.e., milling recovery = 63 per cent.).

FEDERATION OF MALAYA RUBBER PRODUCTION.

(In long tons, dry weight)

Month	Estates		Small-holdings (Estimated)		Total	
	1947	1948	1947	1948	1947	1948
January ..	25,822	34,668	26,748	27,321	52,570	61,989
February ..	26,633	28,529	23,370	22,121	50,003	50,650
March ..	27,552	31,888	31,230	26,549	58,782	58,437
April ..	25,300	32,724	24,323	33,684	49,623	66,408
May ..	29,127	33,294	18,009	16,313	47,136	49,607
June ..	30,717	33,246	22,028	27,348	52,745	60,594
July ..	33,366	35,193	20,407	22,972	53,773	58,165
August ..	28,514	33,727	20,537	22,875	49,051	56,602
September ..	32,070		21,412		53,482	
October ..	33,078		31,844		64,922	
November ..	36,050		18,419		54,469	
December ..	31,636		27,037		58,673	
Total ..	359,865	263,269	285,364	199,183	645,229	462,452
Total 1946 ..	173,515		229,692		403,207	

Small-holding production is estimated from the formula: Production + imports + opening stocks = exports + consumption + closing stocks.

FEDERATION OF MALAYA

PRODUCTION OF COPRA, COCONUT OIL AND COPRA CAKE.

(in tons)

Month	Copra Production		Coconut Oil Production				Copra Cake (Poonac) Manufactured	
			Copra Treated		Coconut Oil Expressed			
	Estates 1948	Small-holdings (estimated) 1948	1947	1948	1947	1948	1947	1948
January ..	—	—	7,324	6,429	3,703	3,302	3,034	2,512
February ..	—	—	7,632	6,231	3,892	3,224	3,138	2,432
March ..	—	—	8,267	7,614	4,264	3,910	3,351	2,913
April ..	—	—	7,590	8,146	3,897	4,054	3,071	3,223
May ..	—	—	8,511	6,225	4,355	3,124	3,396	2,446
June ..	—	—	8,458	7,620	4,370	3,729	3,443	2,955
July ..	2,971	2.619	9,408	7,340	4,808	3,625	3,826	2,901
August ..	2,227	8,731	8,801	8,840	4,491	4,556	3,614	3,484
September ..			8,902		4,554		3,651	
October ..			8,753		4,478		3,560	
November ..			8,518		4,329		3,454	
December ..			7,994		4,045		3,222	
Total ..			100,158	58,445	51,186	29,524	40,760	22,866

Notes:—1. The above statistics are supplied and published by the Acting Registrar of Statistics, Federation of Malaya.

2. Estate copra production and coconut oil production are as declared by estates and oil mills respectively.

3. Statistics of small-holding coconut oil production are not available.

4. Small-holding copra production for commercial purposes is estimated from the formula: imports + estate stocks (opening) + estate production + small-holding production = exports + local oil mill consumption + estate stocks (closing).

5. Statistics for copra production are not available prior to July, 1948.

METEOROLOGICAL SUMMARY, MALAYA, JUNE, 1948.

Locality.	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day.	Number of days					Total	Daily Mean	Per cent.
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F			Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
										ins.	m.m.	ins.								
Ipoh, Perak ..	92.5	72.6	82.5	97	70	88	75			3.07	78.0	1.57	9	8	1					
Port Swettenham, Selangor	89.6	72.9	81.3	92	71	82	75	85.4	85.6	4.22	107.1	1.36	11	8	2	1	1			
K. Lumpur, Selangor ..	89.9	73.1	81.5	93	71	84	75			4.96	126.0	1.81	11	8	3	3	1			
Sitiawan, Perak ..	90.2	72.9	81.5	94	70	85	75	85.3		1.40	35.6	0.61	5	5	1		1			
Kuala Lipis, Pahang ..	90.2	72.3	81.3	94	70	86	75	85.5	85.5	0.84	21.3	0.27	8	6	3	22	1			
Kuantan, Pahang ..	89.3	72.5	80.9	93	70	79	75			4.42	112.3	1.03	10	9	7	2				
Temerloh, Pahang ..	–	–	–	–	–	–	–			1.35	34.3	0.85	8	3		3				
Bayan Lepas, Penang ..	88.7	75.0	81.9	90	73	79	77			3.18	80.8	2.04	8	8	3		1			
Malacca ..	86.0	74.7	80.3	88	71	82	78			13.28	337.3	5.14	16	13	3		1			
Mersing, Johore ..	87.6	72.8	80.2	91	70	83	75			5.77	146.6	1.83	17	14	8		3			
Alor Star, Kedah ..	90.7	74.3	82.5	94	71	81	77			3.28	83.3	0.80	10	10	1					
Kota Bharu, Kelantan ..	–	74.7	–	–	72	–	77	85.9		7.89	200.5	2.03	15	15	7					
K. Trengganu, Trengganu	90.3	73.5	81.9	94	71	85	76			3.89	98.8	1.61	7	7	5	3	1			
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. ..	74.2	63.1	68.7	78	59	66	65	71.6		2.33	59.2	1.61	10	5		9				
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	73.4	55.7	64.5	79	48	69	61	69.6	70.3	2.71	68.8	1.17	7	6		1				

Compiled from Returns supplied by the Malayan Meteorological Service.

METEOROLOGICAL SUMMARY, MALAYA, JULY, 1948.

Locality.	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes								Number of days								
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F	Total		Most in a day. Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
										ins.	m.m.	ins.								
Ipoh, Perak ..	92.3	72.8	82.5	95	70	81	76			3.71	145.0	3.14	16	8						
Port Swettenham, Selangor	89.5	72.3	80.9	91	70	85	76	85.1	85.5	5.04	128.0	2.06	11	8						
K. Lumpur, Selangor ..	89.7	72.8	81.3	93	70	85	75			4.80	121.9	1.91	11	6	2	3				
Sitiawan, Perak ..	88.9	72.4	80.7	92	70	79	75	84.7		4.18	106.2	2.11	10	8			1			
Kuala Lipis, Pahang ..	88.6	71.5	80.1	93	69	83	73	83.9	84.9	8.20	208.3	1.93	15	11	2	20				
Kuantan, Pahang ..	90.1	71.3	80.7	92	68	82	74			9.43	239.5	1.36	17	15	6	7				
Temerloh, Pahang ..	–	–	–	–	70	–	75			10.57	268.5	3.17	19	13	2	4				
Bayan Lepas, Penang .	87.3	74.5	80.9	9	72	79	77			7.24	183.9	2.76	15	10	1					
Malacca ..	85.1	73.1	79.1	87	70	79	77			11.17	283.7	2.58	17	14	3		3			
Mersing, Johore ..	86.1	72.0	79.1	89	70	77	74			8.11	206.0	1.08	19	16	4					
Alor Star, Kedah ..	88.2	74.0	81.1	92	72	81	76			8.67	220.2	2.65	16	13	5					
Kota Bharu, Kelantan ..	–	73.7	–	–	72	–	77	84.6		7.26	184.4	1.58	16	15	7					
K. Trengganu, Trengganu	89.0	73.0	81.0	92	71	85	76			3.41	86.6	0.61	16	15	3	1				
HILL STATIONS																				
Fraser's Hill, Pahang 4268 ft. ..	74.3	62.3	68.3	77	59	72	64	71.7		8.30	210.8	1.46	20	13	1	9				
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	73.3	55.3	64.3	77	49	69	60	69.2	69.9	4.72	119.9	1.63	14	12	1	2				

Compiled from Returns supplied by the Malayan Meteorological Service.

METEOROLOGICAL SUMMARY, MALAYA, AUGUST, 1948.

Locality.	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of		Absolute Extremes							Total		Most in a day.	Number of days					Total	Daily Mean	Per cent.
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F			Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
										ins.	m.m.	ins.								
Ipoh, Perak ..	91.6	73.4	82.5	95	69	81	76			4.48	114.1	2.24	9	7						
Port Swettenham, Selangor	89.8	72.7	81.3	94	70	84	75	85.4	85.4	5.92	150.4	2.51	14	11	1					
K. Lumpur, Selangor ..	89.8	73.0	81.4	95	70	83	74			4.38	111.3	1.86	10	6	3	2				
Sitiawan, Perak ..	89.2	73.3	81.3	92	70	84	76	85.0		3.55	90.2	1.78	11	10	1					
Kuala Lipis, Pahang ..	89.7	72.2	80.9	94	69	83	75	84.7	85.0	3.09	78.5	0.69	13	10	4	20	1			
Kuantan, Pahang ..	90.6	71.7	81.1	94	69	84	74			7.19	182.6	1.19	16	13	9	3				
Temerloh, Pahang ..	–	–	–	–	71	–	75			1.83	46.5	0.51	12	8		5				
Bayan Lepas, Penang ..	87.4	74.9	81.1	90	72	79	78			7.59	192.8	2.00	10	8	1					
Malacca ..	85.7	74.4	80.1	89	68	82	69			6.17	156.7	1.27	19	16	1					
Mersing, Johore ..	86.9	72.6	79.7	91	70	81	75			5.52	140.2	1.63	15	13	10					
Alor Star, Kedah ..	87.9	74.5	81.2	90	70	79	77			13.04	331.2	5.90	12	11	1		1			
Kota Bharu, Kelantan ..	–	74.0	–	–	70	–	77	85.0		8.66	220.0	3.02	13	11	6	1				
K. Trengganu, Trengganu	89.0	72.8	81.0	92	69	83	75			5.57	141.5	1.66	15	10	5	1	1			
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. ..	73.7	62.5	68.1	77	58	69	64	71.5		6.85	174.0	1.72	15	12	3	12				
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	72.7	55.6	64.1	77	49	65	60	69.1	69.7	6.62	168.1	1.43	17	13		4				

Compiled from Returns supplied by the Malayan Meteorological Service.